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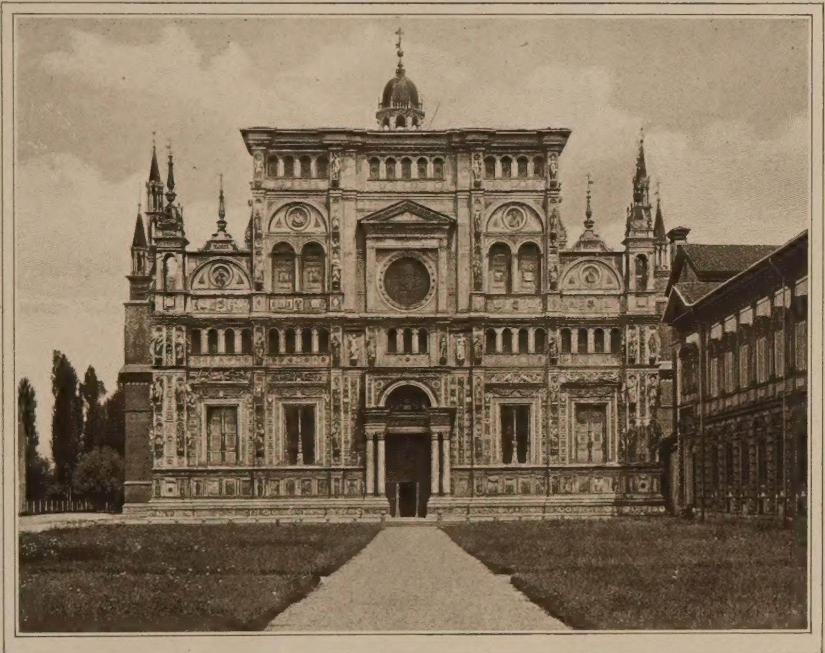
The Certosa of Pavia

By Frank Jewett Mather, Jr.

I

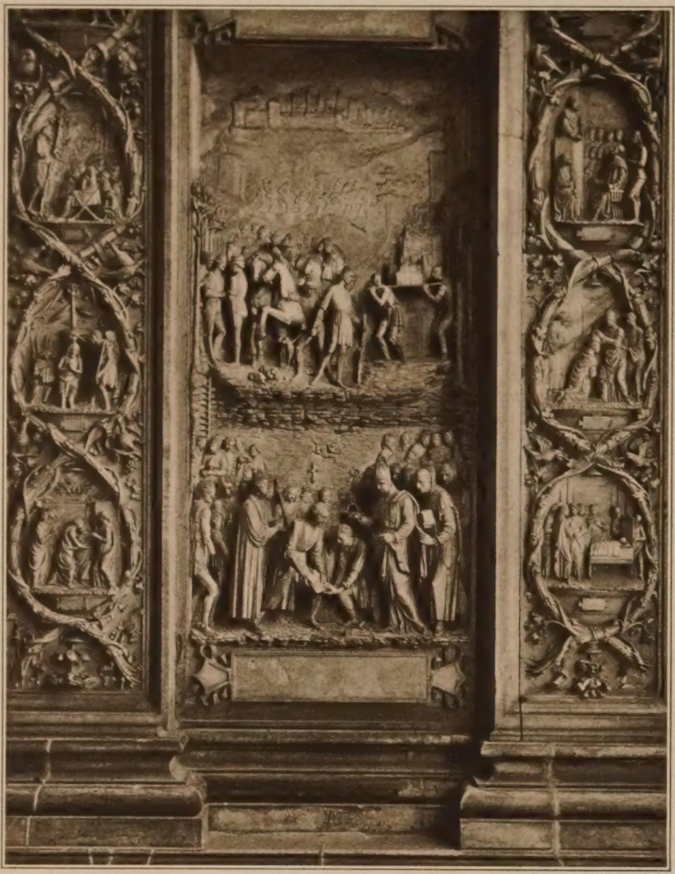
THE Certosa of Pavia lies vacant and solitary in the endless Lombard plain. From afar one sees the light arcades of the octagon drawing in tier by tier to uphold the slender lantern, but the rest of the big monastic pile squats sullenly behind its walls, as if it renounced its site and surroundings. And this forbidding quality persists even when one enters the close. This Carthusian abbey has nothing of the pathos of a dead building giving itself back to the soil under the influence of sun, wind, and rain; it displays instead the aggressive spick-and-spanness of a well-kept national monument. Have you ever seen a bedizened Pharaoh exposed in a museum, mortal but hopelessly incorruptible, a butt for the chatter of guides and tourists? That is the plight of the Certosa of Pavia.



That fair but false miracle, the façade.

Such it was, for, incredible as was the elaborateness of this design, it was promptly outbid by the terra-cottas of the great cloister. By the simple expedient of alternating white columns with rose-colored, and enlarging the tiny caryatids to nearly life size, a new note of color and a whole battalion of imposing effigies were obtained. And then both cloisters were outdone in marble on the façade, where for the space of two generations Gian Galeazzo's money was cheerfully chipped away.

I have no wish to follow the story through the building, or rather the embellishment, of this front. Three better designs had been considered and rejected before it was committed to the Amadeo and Mantegazza families, shrewd artisans who had come to the Certosa in the humble capacity of stone-cutters and had grown up with the building. They knew a good job and according to their lights tried to give a good money's worth. Wherever a bas-relief or a statue might be put they put one or several. The façade blossomed into profane effigies and sacred stories, as the routine imagination of the monks directed the chisels of the master workmen. In the borders, capitals, columns, bases, sills, and buttresses they lavished an invention always ingenious, and sometimes exquisite in its overblown fashion. Considered as so much mellowed and corrugated marble, it is very beautiful, especially as glimpsed from the outer portal. But it exercises, after all, merely the charm of fancifully intricate workmanship. It goes with carved cherry-stones, or, more amiably, with the frost crystals on the window-pane. Borgognone, after the first architects the single fine and restraining influence in the enterprise, is supposed to have had a hand in the riot of stone-cutting he surely must have disapproved. One is tempted to credit him with some of the charming decorations that ripple about the windows, and we perhaps have better warrant for believing that he designed the bas-reliefs of the entrance, depicting the founding of the Certosa by Gian Galeazzo and the transportation thither of his body. In any case, these stories, with their exquisite setting of biblical subjects in a trellis, surpass anything we have from the stolid talents that contrived the rest of the front. On the whole, one shares Erasmus's lack of patriotism. Indeed, even the enthusiasm of the monks gave out after a time, and they hastily finished the half-done task by embedding the left-over bits of sculpture in the papery panels above.

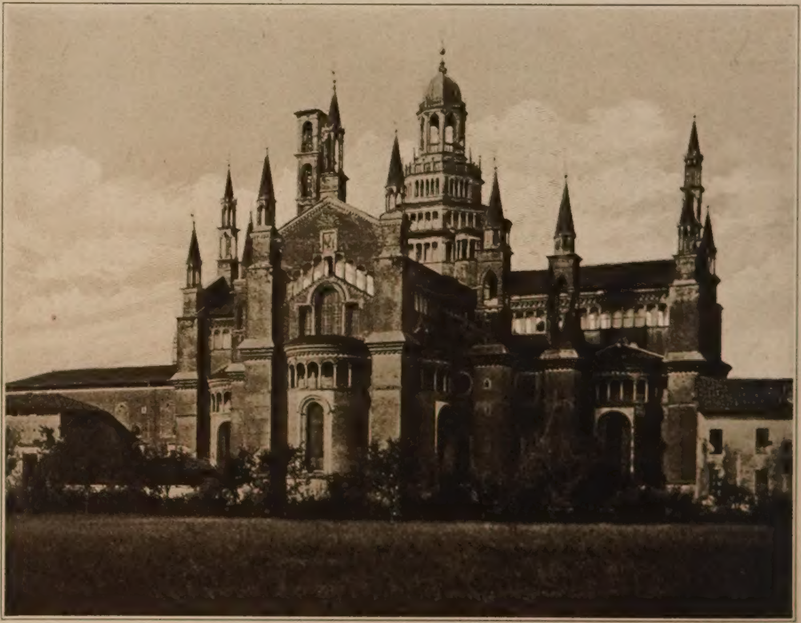


Gian Galeazzo laying the first stone, August 28, 1396, of the church portal, executed about a century later. The design is ascribed to Ambrogio Borgognone.

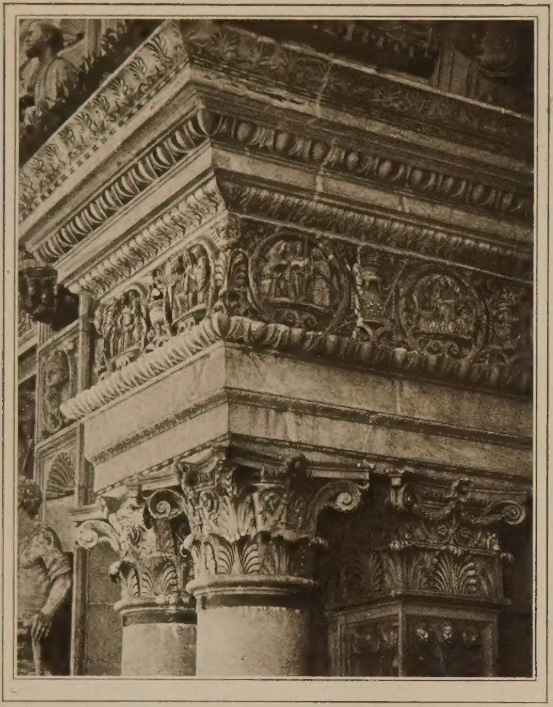
Had the Carthusians rested there, one would feel more kindly toward them. But they merely arrested the upcreep of sculpture on the façade to start a fury of decoration in the side chapels within. These quiet recesses, which at the best had been tastefully decorated by painters of the early Renaissance, and at the worst remained in seemly rough cast, were with a few blessed exceptions to be turned over to the sugariest and most flamboyant artists of the baroque period. A tedious Pavian family named Sacchi, whose forte was transposing embroidery designs into semiprecious stones, was to succeed to the Mantegazzas and Amadeos. Of all this work there is little left to be enjoyed except the admirable gratings and occasional fine bronzes. Metal seems antiseptic. In periods of decline, the art of the smith retains something of primitive vigor, and possibly one might best illustrate the true continuity of art by sticking to iron and bronze. As for the chapels, about the best one can say is that the architectural arrangement happily conceals them, and that the founder would probably have approved heartily of their over-decoration.

It may seem that one does Gian Galeazzo an injustice in holding him responsible for the extravagances he did not live to witness. But study his face as it meets you in the outer portal, in the lovely reliefs of the entrance, over the door of the old sacristy, high up in Borgognone's fresco, in miniatured choir books, and over the exit to the cloister—where at last you shake him off—and you will find that these many portraitists have united in one, and not an agreeable, interpretation. The forehead projects in a keen ridge over the full orbits, only to recede unpleasantly under the long hair brushed straight down the temples. Beneath the inquisitive and acquisitive nose the smooth-shaven lips are firmly set. The chin protrudes stubbornly—an effect exaggerated by a wisp of pointed beard, but this impression of power is somewhat cheapened by the grossness of the pendulous double chin. In all these portraits there is an incongruous hint of the devilish sly Yankee deacon of caricature, but the large eye, with its massively cut socket and lid, tells quite another story—of passions, or at least of indulgences, more rightly to be associated with the Mother Church than with the meeting-house.

Here, unless his features belie him, was a man not given to fastidiousness. In honoring his memory with a magnificent church, that was mostly a decorator's church, the monks did about what he would have done himself. They wanted, as he would have wanted, something more dazzling and costly than Lombardy had yet seen, and the Mantegazzas and Amadeos were precisely the men to enlarge upon such instructions. It all corresponded to the dynastic ambitions of the donor. In the few years between the Duchess Caterina's vow and the laying of the first stone in 1496 his intentions for the Certosa were growing rankly. Toward the last actual delusions of greatness seem to have centred about the temple, or rather the pit that represented it. In his imagination it rose no longer a simple memorial to Caterina or



The Certosa of Pavia—seen from behind.



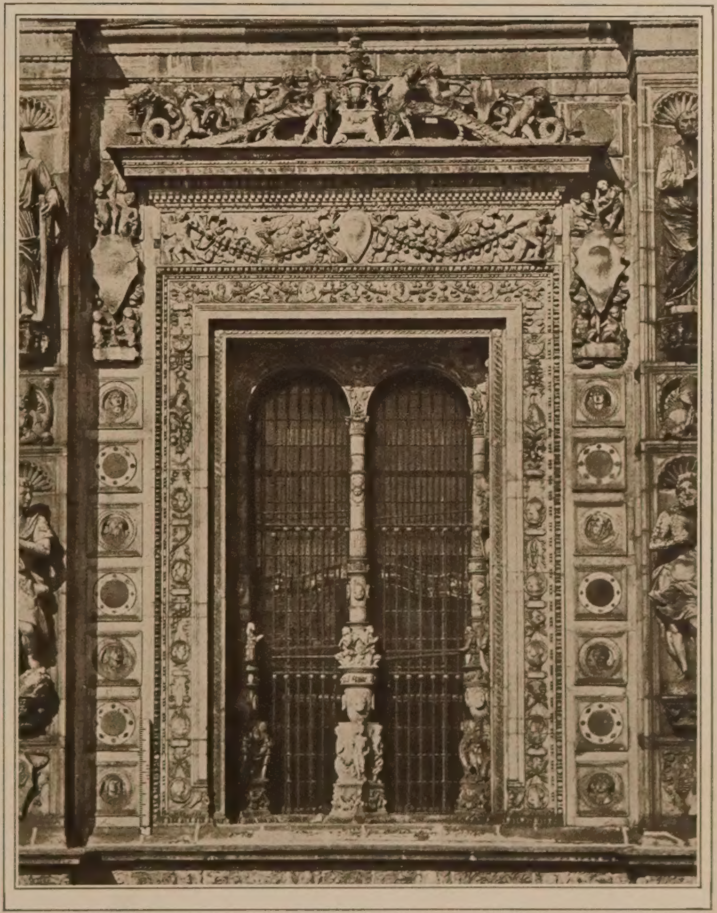
The façade—capitals with entablature and cornice.

an offering to Our Lady, but a mausoleum for the dynasty he believed he had founded. Gian Galeazzo entertained kingly ambitions, and with a certain warrant, for kings craved his alliance, and his domain had stretched to Sienna and Spoleto, enveloping redoubtable Florence. The regalia had been ordered, so the chronicler Poggio tells us, when Gian Galeazzo fled from the plague at Pavia, only to die at Melagnano in September, 1402, in his fifty-second year. Seven years earlier he had ordered his tomb at the Certosa in royal state. At Milan he had treacherously slain his uncle Bernabo, co-heir of Lombardy, so he preferred to lie rather in the abbey that was to rise near Pavia than in the great white cathedral that already towered above the scene of his foulest usurpation.

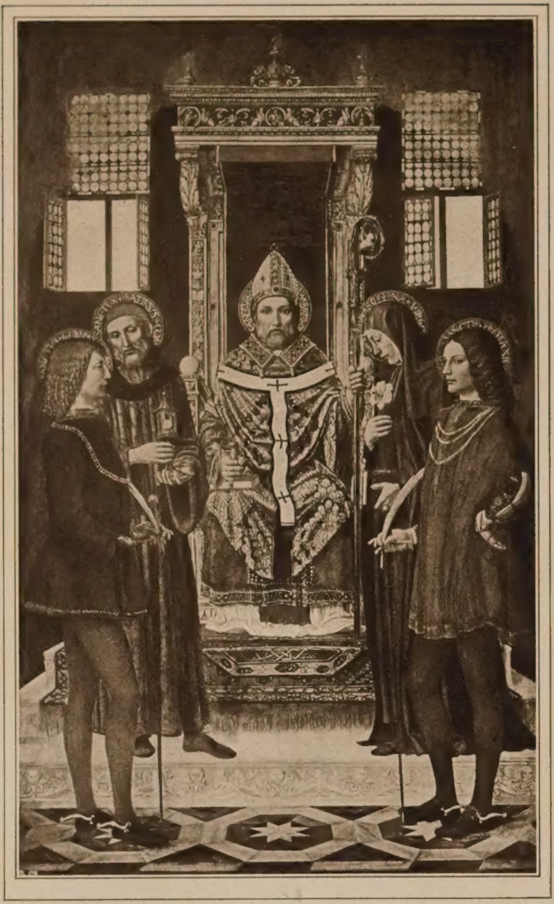
So he commanded "a marble chair nine steps high to be built behind the high altar, and on that chair to be cut the figure and effigy of this testator, as seemly as may be in marble, the ducal form and costume, in and under this chair a marble sarcophagus . . . in which the body and heart shall be buried and concealed." Having provided for his own splendid sepulchre, he ordered as well on his right a tomb and effigy for his first wife Isabella, and on the left similar honors for his second wife Caterina, their offspring to be buried in the order thus established for the entire line of Visconti.

You may seek in vain for the towering throne and ducal image behind the high altar; you shall find in the Certosa neither the grave of Isabella nor of Caterina. It was seventy years before the body of Gian Galeazzo lay in the church in a kind of makeshift state. It had passed from the Abbey of Viboldone, where the first masses were sung, to the Cathedral of Milan, where the draped coffin hung in the choir arch for a generation. It approached its last resting-place by way of the venerable church of S. Pietro in Ciel d'Oro at Pavia, and was fairly forced into the Certosa by the indignant urgings of a descendant, Galeazzo Maria Sforza. For a time it lay behind the high altar, indeed, but surmounted not by the throned figure required in the will. An equestrian portrait, presumably made for another purpose, guarded the coffin when the gossiping Commines saw, and, he assures us, smelled, the bones of Gian Galeazzo. Later they were relegated to the right transept, in contravention of his wish, and enclosed in the fine tomb which we still see, and it has been twice violated. His wish that the Certosa should be the mausoleum of the Visconti is fulfilled most imperfectly by the lovely cenotaph of Lodovico il Moro and his wife Beatrice d'Este. For if Lodovico was remotely of Gian Galeazzo's blood, the Sforzas had in turn usurped the Lombard state.

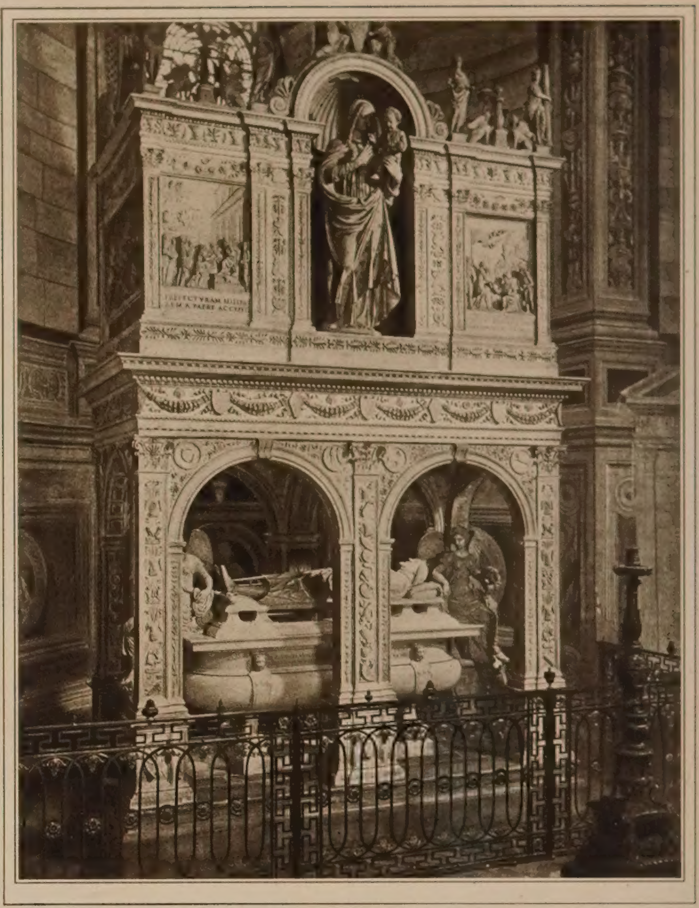
If I have recounted perhaps at undue length these disregarded ambitions of the founder and the odyssey of his mortal remains, it is because in a manner these facts explain the somewhat composite and inharmonious nature of the Certosa itself, and because they go far toward answering Erasmus's query as to the sense of it all. We have seen that it quickly outgrew its finer and simpler origins in the zeal of a monk and the fears of a godly woman, and came to express mainly the pride of a prince, inherited and enhanced by many generations of too prosperous monks. Its history, or absence of history, betrays the barrenness of such a foundation. Let us trust that after a reasonable interval of intercession the soul of Gian Galeazzo was in a position to face St. Peter; his lands and money, so far as the annals show, were less productive of piety and scholarship than so shrewd a dealer in futures had reason to expect. It is part of the divine irrelevance



A window of the façade.



St. Ambrose enthroned, with four Lombard saints, by Ambrogio Borgognone.



Tomb of the founder, Gian Galeazzo.

of art to convert to finer purposes the narrow designs of donors and patrons. If the Certosa is something better than a museum of Renaissance decoration, if one still finds in it a higher pleasure than one gets from the picturesque, or from sentimental reconstruction of the princely life of the monks, it is because the work enlisted at least one exquisite artist, Ambrogio Borgognone, and something of fine original purpose persisted through all changes. The temple itself has never quite forgotten that it must symbolize the beauty and simplicity of holiness. We know the names of the three architects who drew the plans, Bernard of Venice, Giacomo da Campione, and Cristoforo Beltramo, but we may only surmise who it was that gave this, almost the last of Lombard Gothic churches, the form it still retains. One likes to think that Stefano Macone, who had inspired the Duchess Caterina's vow, may have had a voice in the matter. In any case, when work was resumed on the old foundations after a lapse of fifty years, an aged architect, Cristoforo da Conigo, who had been present at the laying of the first stone fifty-six years earlier, was called in to advise the new architect, Giovanni Solario. We may suppose that this single survivor of the Gothic beginnings saw to it that they should be respected by these builders of the classic revival. Only through some such piously conservative influence could a building of the Renaissance remain so loyally Gothic in spirit.

Without the touch of Ambrogio Borgognone the Certosa would be merely one of many fine Lombard interiors, notable for the light spring of its massive vaults, for the beauty of its painted windows, but, after all, the counterpart of dozens of churches of the plain. It remained for Borgognone to lend it a peculiar decorative elegance which dignifies it not merely among Italian churches but also among those of Europe. He came to the work in 1490, and while the journeymen sculptors outside were chiselling the façade like a sugar-cake, he and his brother Bernardino were drawing delicate borders along the stout vaulting ribs, crowning the main arches and wreathing the little chapel arcade with similar patterns—everywhere imposing upon the roseate brown of the interior a celestial hint of blue. In the vaults they dared more, raising the pale tone to a vivid, and near the crossing, where the eye rests, tracing a simple geometrical pattern. In the transept again they stretched the blue behind the two apsidal groups of Viscontis and Sforzas who kneel by the Virgin's throne, proudly, as great lords may before so great a lady. On the transept walls they set graceful whorls of ribbon against the blue, and up and down the nave above the piers they placed medallions apparently opening to the sky, to bind the azure of the ceiling in with that of the two ranges of supporting arches. Thus they decked the abbey discreetly in the Virgin's color, modestly, as should be adorned the lady of the land, while outside the sculptors were providing it with a stone breastplate more ornate even than a Milanese corselet of the time.

(*To be continued.*)

For the Student of Architecture

By David Varon

Author of "Indication in Architectural Design"

BEFORE taking up the study of architecture one should feel the calling, else it is no use starting. For architecture is an art, and while one may guide an art-student's efforts, one can hardly do more than to instil in him the enthusiasm which belongs truly only to those who *feel* the calling of the profession.

Once there is started the sacred fire of love for an ideal and the desire to express it in architectural forms, the student can be helped to find the way toward practical architectural design.

What is commonly termed the appreciation of architecture is mainly associated with the laymen and he should be encouraged in his patronizing of art or architecture by a genuine love for them. It seems to be incumbent upon the architect to help to further the educational work so essential in bringing up the masses to the realization of what a real work of art is, which is a hard enough thing to do when dealing with sculpture and painting, but how much harder with architecture.

The commonest way of reaching the stage of good design is not unlike that of good writing. First comes the vocabulary, then the forming of phrases, paragraphs, and chapters, finally treatises and books. The process is also about the same in the cultivation of the other arts. But while one may learn correct use of English, and clearness in the study of grammar, one will never find in it inspiration. And this is what gives a soul to a creation. A masterpiece of painting is, as well as sculpture, the expression of an idea in terms comprehensible to the public at large. It is to learn the interpretation of great ideas in a natural yet distinguished manner that keeps students for years in search of master works, comparing them to their surroundings and analyzing the qualities which give each work its attraction. It is in this same manner that the architects of the Renaissance studied Roman antiques with a desire not to copy, but to receive inspiration.

Not only is there similarity in the process of studying the various arts, and architecture, but they all tend to express more or less the same feelings or moods in different manners. And he can best say he is thoroughly familiar with one particular mood or expression in architecture, when he appreciates the corresponding one in one of the arts. It is well to remember that in the time of the Renaissance, architects were nearly always painters as well as sculptors.

The above points the way to proficient study. First, we must see types of structures, edifices of the same family treated in about the same manner, then go over edifices of another class. From the mere comparison of these analogies and contrasts will come forth a fertile teaching.

All this can be done in one way: observation, which will be greatly helped by drawing from the work itself with enthusiasm not only for the details, but especially for their distribution on the main lines. The mechanical reproductions of proportions and details may give an idea of camera resemblance, but never the artistic impression that results from just a few strokes of properly selected elements in the right proportions.

Drawing, more drawing, and constant drawing, is the essential to make the qualities of a good analyst first, and, next, a designer. The latter will find interest before a mere enclosure wall with its gate—like those we meet in Italian villas—as much as in the most gorgeous monument, and it will help develop a sense of fitness and of measure, in a word of harmony.

THE STUDY OF NATURE

Nature will teach us more than one lesson of architecture whether it be by the differentiation of species in animals and plants or by showing us in a striking manner the difference between beings and plants created for a definite constructive purpose; some requiring adequate equipment, prohibiting purely ornamental accessory and, on the other hand, species whose unique purpose seems to be the charming of the eye or the ear as flowers and ornamental trees, song and plumage in birds, etc.

Many a modern artist has gone to nature not only to get some ideas, but direct inspiration. Not long since one of them, Binet, made special studies of aquatic creations and applied his observations in a very decorative manner in his architectural ornamentations.

The study of nature is the one thing in which a true lover of art should be indefatigable. He will see in the tiniest and simplest as well as the most complex plant or animal, a programme of nature solved in a clear, definite manner. Our inspiration will be greatly helped through an understanding of the relation between the animal or plant and its function.

Whether we can explain the place occupied by the woodpecker or the warbler in creation, it matters comparatively little once we notice the change in physical appearances correspond to functional differences. The existence of the peacock is a pretty clear demonstration of the need of purely æsthetic beauty in the world. On the other hand, other species show the idea of *service* stretched to its limits. But with a few exceptions, we find in creation almost everywhere a touch of grace. This is the great lesson for us, that no matter how utilitarian our programme be we ought to instil in it a touch of beauty, be it in shape, in line, or in color, according to the case, and take advantage of every possibility to do so. Furthermore, we will find that in many cases what is thought to be a superimposed element, beauty, is merely dictated by necessity, order, safety, protection of the structure itself.

It is such a moral help to find in nature, the ocean of great inspiration constantly working for us, constantly rejuvenating itself. The study of nature and man helped the Greeks to foster their architecture, and to be thoroughly understood it ought to be seen under this light. The natural inference of this is that we ought to draw from life, nature, and architecture simultaneously, so as to understand and appreciate better all of them.

THE VALUE OF FREE-HAND DRAWING

The beginning of real architectural design is not to be found in the work done with dividers and all sorts of instruments, but in free-hand drawing from a well-liked feature. Those efforts are most fertile in results which are exerted before the masterpiece in an attempt to reproduce free-hand the best qualities of the model. Many will be the stumblings, but as many times the student will pick up his courage and at last triumph over all the difficulties.

To the true lover of architecture there is hardly need to urge the amount of time he should devote to drawing for he will be doing that all the time almost unconsciously, practising not only from the model, as a pianist from his notes, but trying himself at memory work. Students who have practised long enough reach the point where they can reproduce pretty faithfully a well-known edifice or architectural composition from memory. We can see no reason why it should be different in our art than in other arts or literature. Macaulay is said to have been able to memorize "Paradise Lost" and many other long poems.

The advantage of this memorizing work is self-evident especially when it has been assimilated, which cannot be without a thorough analysis going to the very core of the compositions, to the very principles embodying their beauty. It is a blessing to be able to carry faithful memory impressions, and to sift them in the light of art, analyzing in leisure moments the merits or demerits of such and such a composition in the whole or in details. What Macaulay did for literature we ought, each one of us, endeavor to do for our art, first for the pure enjoyment of it, and then for the profit ensuing from it. It is like supplying the brain with inestimable stores of ideas in which you may delve at your leisure, and nothing helps better to do this than drawing after deep scrutiny.

It is obvious that the mere camera eye will not be able to fix alone the feature in the mind. Historical facts will give it much strength and the observations made by the student, the relations which he may establish between each feature and some outer fact, will still more favor the fixing of the impression on the brain.

In this respect the good instructor is the one who can give the student the key to the secret of studying by himself. No matter how valuable the instructor's work is in helping us, it is by our own efforts that we advance, if we do not become too well satisfied with what we have done. The real beginning of our achievement is when we can ourselves see our shortcomings and be ready to profit by intelligent criticism.

Memorizing is not to be encouraged for mere copying purposes. A true artist will never indulge in such practice, but only for reference and inspiration.

It is self-evident too that it is best for the student-architect to do this work in the light of the science of construction. He will thus learn to discern between what is purely architectonic and what is architectural. The former owes its merits to merely well-proportioned structural elements; while the latter sometimes adds additional elements, symbolical or decorative ornaments, either to perpetuate some tradition or to commemorate a new deed. For instance, the architectonic beauty of a vaulted ceiling consists of the emphasis of its structural elements leading to coffers, ribs, etc., confining itself strictly to the main organs of the structure, whereas the architectural beauty will come out of an attempt of the artist to take advantage of the possibility of the structure to extend its effect or to give a structural element a decorative function to fulfil. Such for instance as detached columns supporting a statue or an ornament. To what extent and in what way this can be done successfully without violating the very fundamental principles of architecture, a comparative work between various masterpieces may determine. The works of many thinkers and critics cannot be ignored, especially since their endeavors tend to retrieve the art of architectural design which now and then falls so low that the public begin to doubt whether architecture is an art at all. Most interesting of all it is to find out how merely structural forms assume a sculptural character. Such is the impressive Greek Doric cap, the ribs in the so-called Gothic architecture, romanesque caps, etc., in fact most structural elements of the Gothic architecture are vested with architectonic beauty. Prominent among them all are the Greek coffers in their temples and the Roman in their Pantheon. The late Professor Guadet used to expatiate on the Greek Doric order as being the very expression of perfection in architectony, "because," he would say, "in this order every part, every element, is so because it could not be otherwise, from the shape of the echinus, crowning the entablature, which obeyed the law of necessity, it serving as gutter, to the mutules which were an interpretation of the wooden elements in the wooden shrines, showing a beautiful alloy of common sense and the respect of tradition so essential at the time when the Parthenon was erected."

In undertaking the task of analyzing and memorizing famous structures, wisdom seems to indicate the simple features first. As in music, after the first exercises simple melodies are played and gradually with the increased skill in exercises more intricate compositions are tried, so too in architectural design programmes may be very small yet differ so much in their character. To interpret them in drawing and rendering according to their meaning in the proper atmosphere is to comprehend thoroughly the grand art of architecture. Even in these small programmes there have to be taken into consideration such items as scale, proportions, silhouette, units, etc., which will be used likewise in more elaborate examples becoming more complex.

We Must Protect Our Forests

GREATER conservation of wood and wood products through protection for the raw material in the forests of the United States is urged by Secretary Houston's assistants in the Department of Agriculture. The secretary's annual report also advocates provisions for pushing more rapidly the improvement work in the forests, for a greater number of forest guards, and for earlier organization each fire season of the protective system.

It is declared that protection of the forests during the present year proved an exceptionally difficult task. An annual strain was imposed on an organization somewhat depleted in numbers and much weakened by the loss of many of its most experienced men. Added to this was the difficulty of securing good men for temporary appointment as guards during the fire season, and parties of men for fighting large fires. An unusually early and severe dry season caused the outbreak of serious fires before the summer protective organization was fully ready.

The department declares that some embarrassment in meeting the situation was caused by the failure of the annual appropriation act to pass Congress until after the fire season was virtually over. Relief was furnished by the President, who placed $1,000,000 at the secretary's disposal as a loan from the President's emergency fund. It may be necessary, the secretary says, to seek from Congress again a deficiency appropriation of $750,000.

An Economical House

Samuel A. Hertz, R.A., Architect

THE purpose is to build an economical house of refined proportions in the colonial style. The dimensions of the building are 31′ 0″ front by 27′ 0″ in depth, and the sun parlor 10′ 0″ by 24′ 0″ in depth.

In planning the house the idea uppermost in the mind of the architect has been a structure of minimum dimensions, that would enable the builder to keep the cost of construction at the lowest possible figure and yet offer the prospective client a plan containing every convenience which the modern housewife might desire to save time and avoid waste of energy.

The plan of the building is in the form of a square. In this plan a difficult problem arose in the preparation of a suitable façade, but it is believed to have been solved with attractive results.

The entire roof is covered with a good grade wood shingle, which should be stained in green; and the shutters, sash, window and door trim, together with the hanging shutters at each projection and the bay window on the second story, are of the same color. The body of the building should be painted white. The main entrance door will be of a mahogany finish. The upper section of this door is provided with leaded-glass sash to give light to the entrance vestibule. The main entrance is provided with an open porch, the pediment above gracefully supported by two colonial columns flanked by a seat on each side resting on a floor laid in tapestry brick and approached by brick steps. The house has been kept 3′ 0″ above grade; an unusually high level, yet most desirable. It saves 2′ 0″ of unnecessary excavation, permitting construction of the basement floor 4′ 0″ below grade, and allowing for the installation of good-sized windows for plenty of light and ventilation. The basement contains a laundry, storage-room, toilet, space for coal storage, and heating plant. The foundation walls are built of concrete 12″ thick, properly water-proofed, together with a concrete floor and 1½″ cement finish.

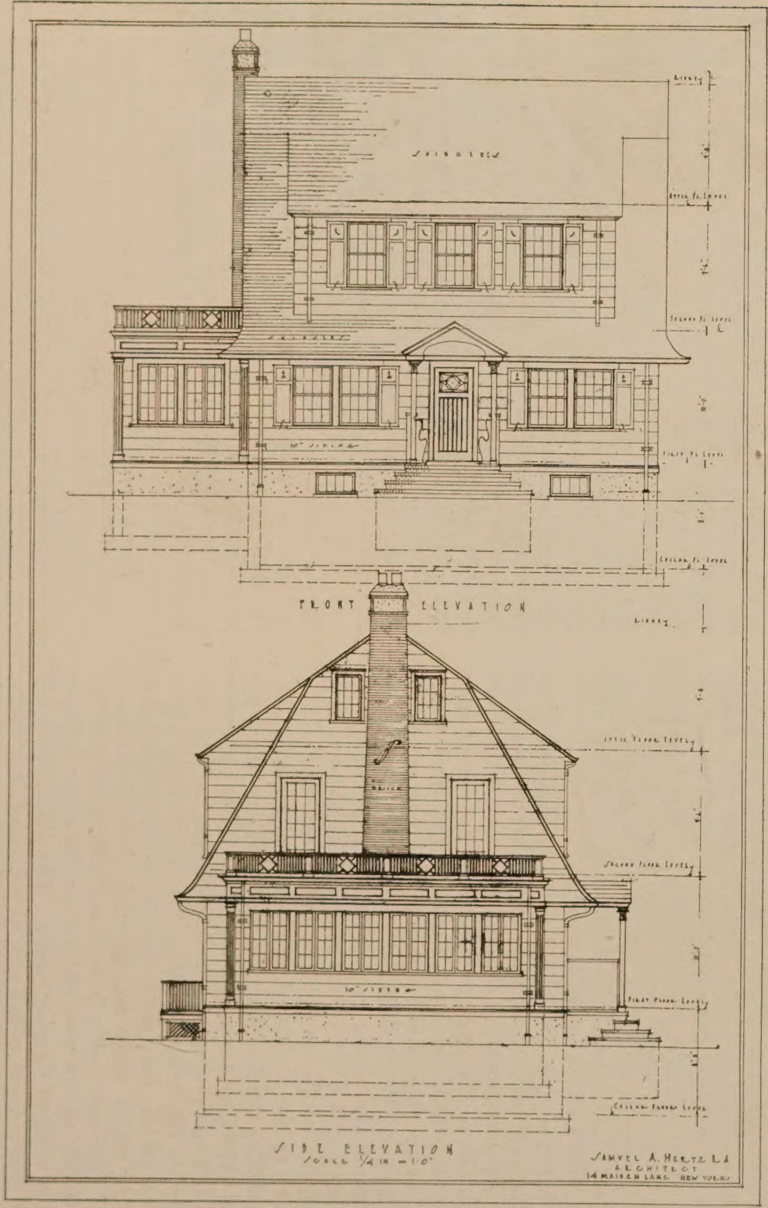
The laundry tubs are placed upon a wood-slat platform as close as possible to the staircase, so that the laundress will be saved unnecessary walking. The same holds true for the location of the storage-room, while the coal storage space is in the rear of the house, accessible from the exterior by a window opening in which will be placed an approved iron coal hopper. While the basement can be reached from the staircase at the service entrance situated in the rear of the building within 3′ 0″ of the rear door, the owner, if he so chooses, can readily install a staircase in a rear area in which area can also be placed an economical ash-hoist lift.

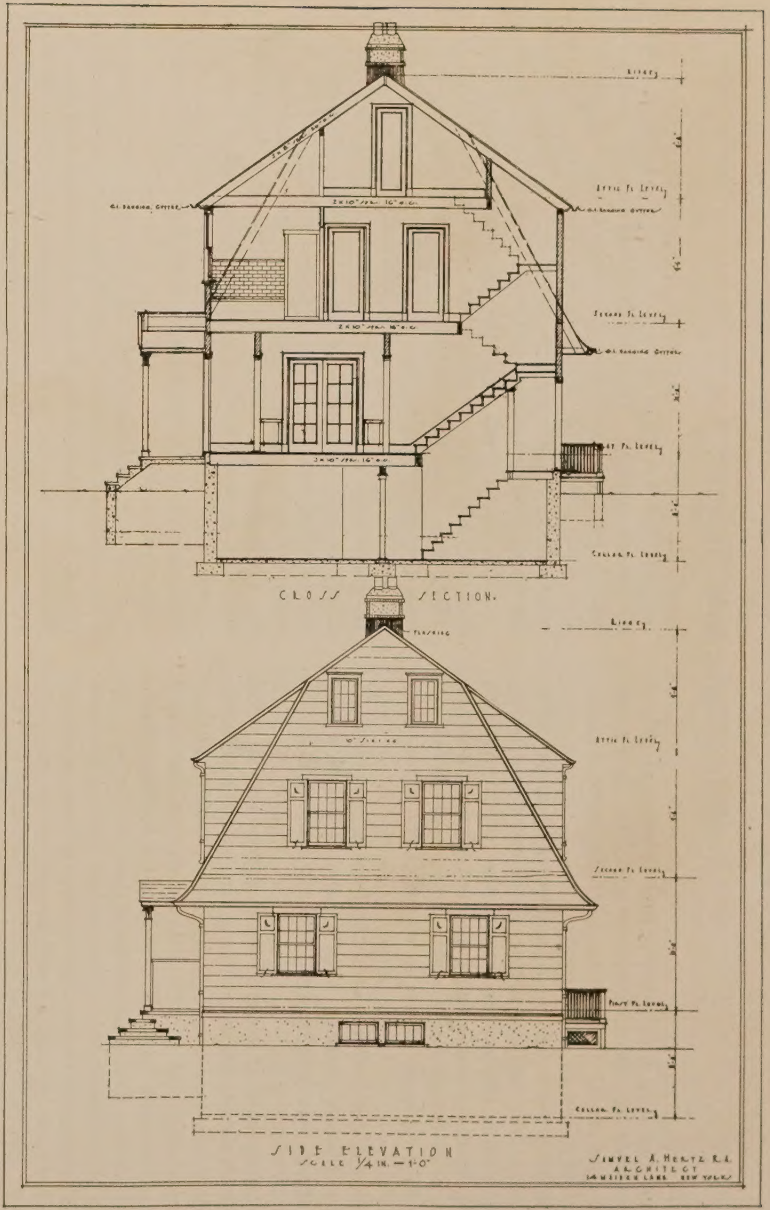
In designing the first floor the idea has been to submit a practical as well as a symmetrical layout. The sun parlor is of good size and proportions, and can be entered from the living-room by two French casement doors, making it possible to shut off this from the remainder of the house, thereby affording ample space and quietude for various social functions. The sun parlor is enclosed with glass sash on all sides which can be removed during the warm weather and can be used as sleeping porch. The living-room occupies the entire depth of one side of the house and is provided with a handsome fireplace built of red tapestry brick set in a neat pattern with a wood mantel over it. The living-room is finished in chestnut, and if the owner chooses he can also install a beam ceiling, in the same finish, at a small additional expense. The floor is of oak parquet with a border. It will be noticed that a vestibule has been provided. This tends to keep the house warm in the winter. The vestibule is made attractive by the installation of a Welsh quarry tile floor with a neat insert and walls of imitation Caen stone.

The plan contains a good-sized dining-room and kitchen with service entrance and place for the installation of a refrigerator, readily accessible from the kitchen as well as from the service entrance. The kitchen contains all facilities needed in a modern household including a good-sized gas-range set on a tile hearth and protected on the back by filling the wall with brick between the studs, three feet high and one foot wider than the range. This arrangement helps considerably to minimize the fire hazard. Large dressers are provided together with a broom closet. An enamelled iron sink is shown set beside the window with a large drain board on each side. This sink is provided with hot and cold water faucets. There is ample space left in the kitchen for one or two tables.

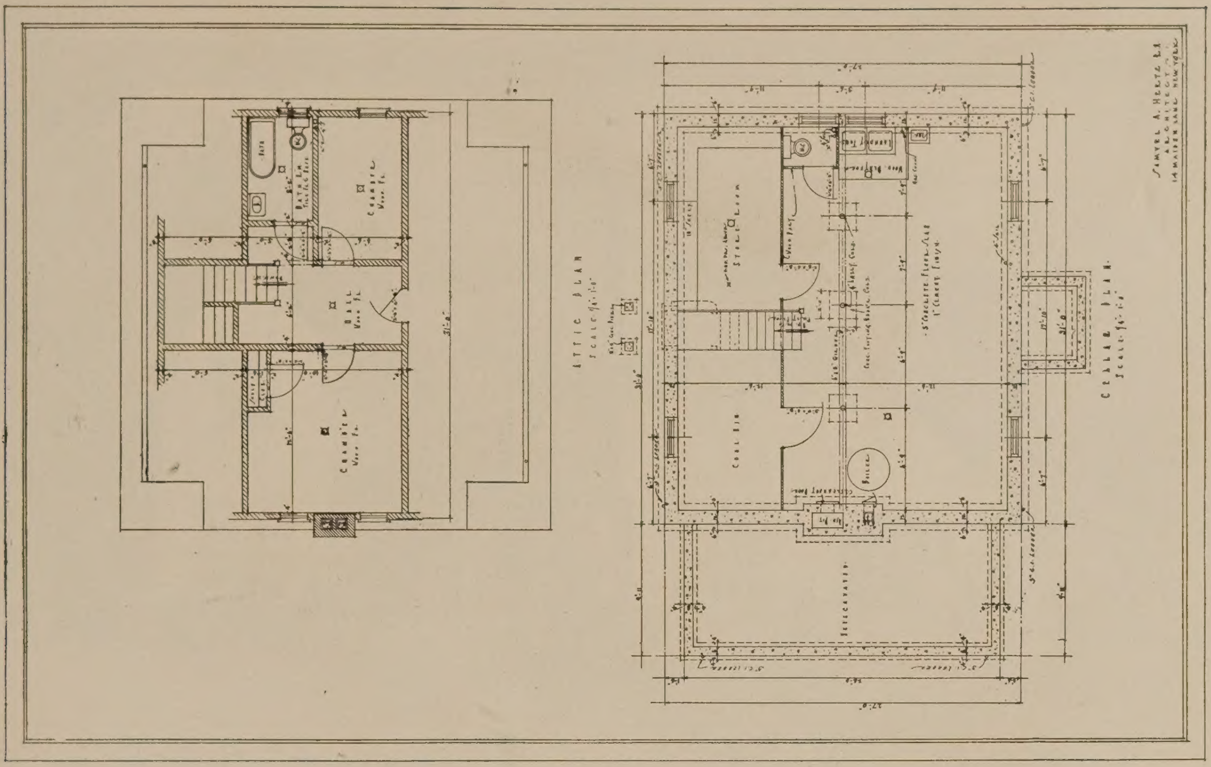
The entrance door from the kitchen to the dining-room is a double-action door. The dining-room is well proportioned, has two large windows and is finished with a parquet floor similar to that in the living-room and hall. The walls are panelled with a Dutch shelf together with a beam ceiling. The woodwork is of chestnut and finished like the living-room. It is entered from the hall through French casement doors. A main staircase has been provided with treads and risers. The newel post is of brick, with a mahogany finish, while the stair railing is finished in white enamel. The second floor contains four large chambers with good-sized built-in closets. The two main chambers are connected by a private passage. The balcony over the sun parlor is provided with a canvas roof, and is accessible from the two main chambers by casement doors, allowing the balcony to be used as an additional feature of the house. The chambers and the hall are finished in white enamel, applied to white wood trim. The doors are birch and finished in mahogany. Each closet door has a mirror insert, full length of panel. The floors throughout are of parquet. The hall contains a good-sized linen closet. The bathroom has a built-in tub and shower-bath. All plumbing fixtures are of modern type with hot and cold water connections. The bathroom contains a tile wainscot 4′ 6″ high with a tile floor and base. As already stated, the attic floor contains two finished chambers and a bath which may be used for guests or servants. Suitable storage space is also provided for in the attic in another separate room facing the hall. Below is an itemized list made in accordance with present-date prices, from which it will be seen that the house can be erected for a sum not to exceed $12,000.00.

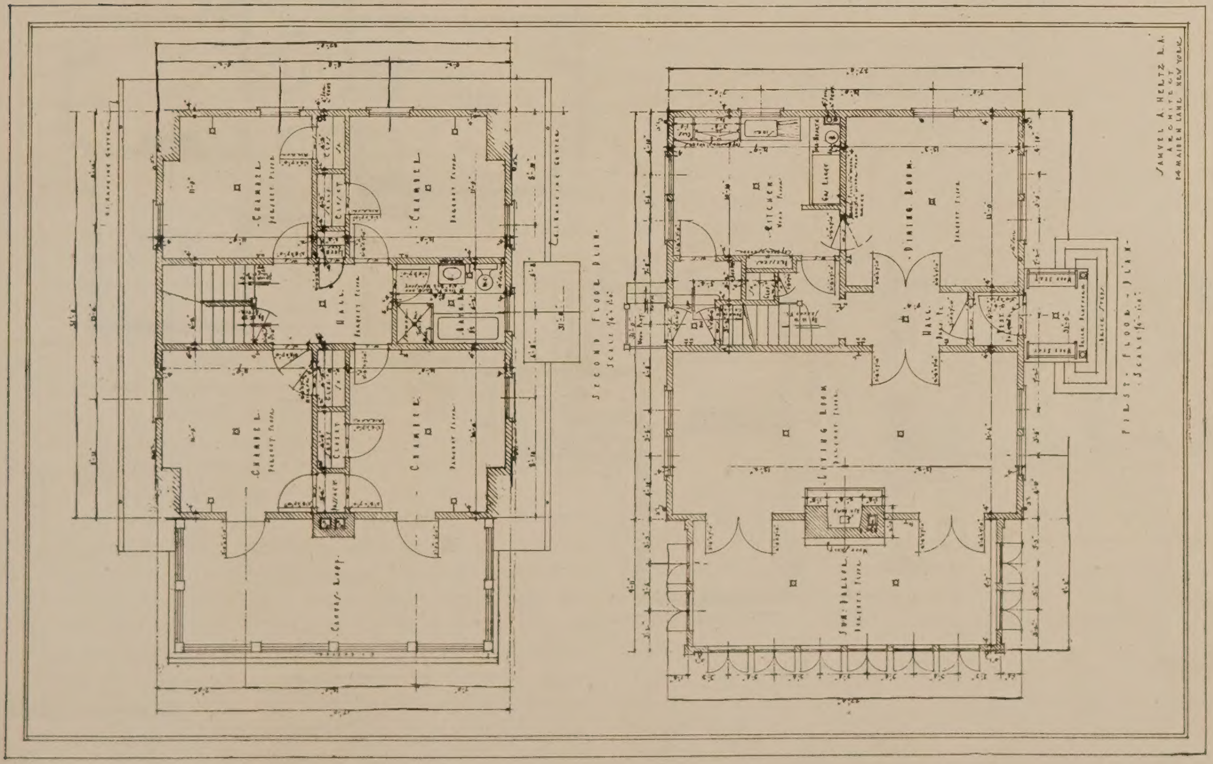
Masonry work	$ 2,600.00
Carpentry work	6,400.00
Electric wiring	450.00
Plumbing	800.00
Steam-heating	750.00
Scraping and varnishing	200.00
Painting	600.00
Tin work	200.00
	$12,000.00

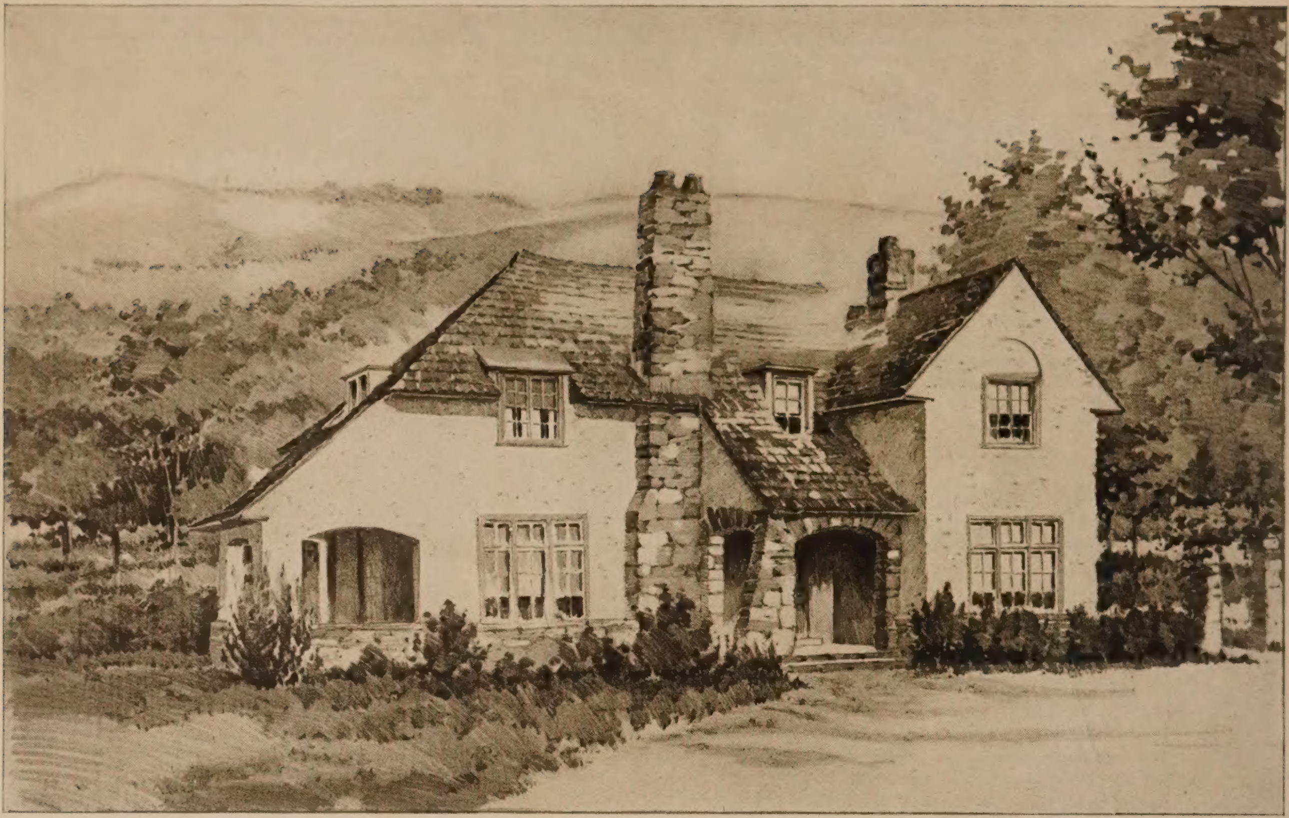


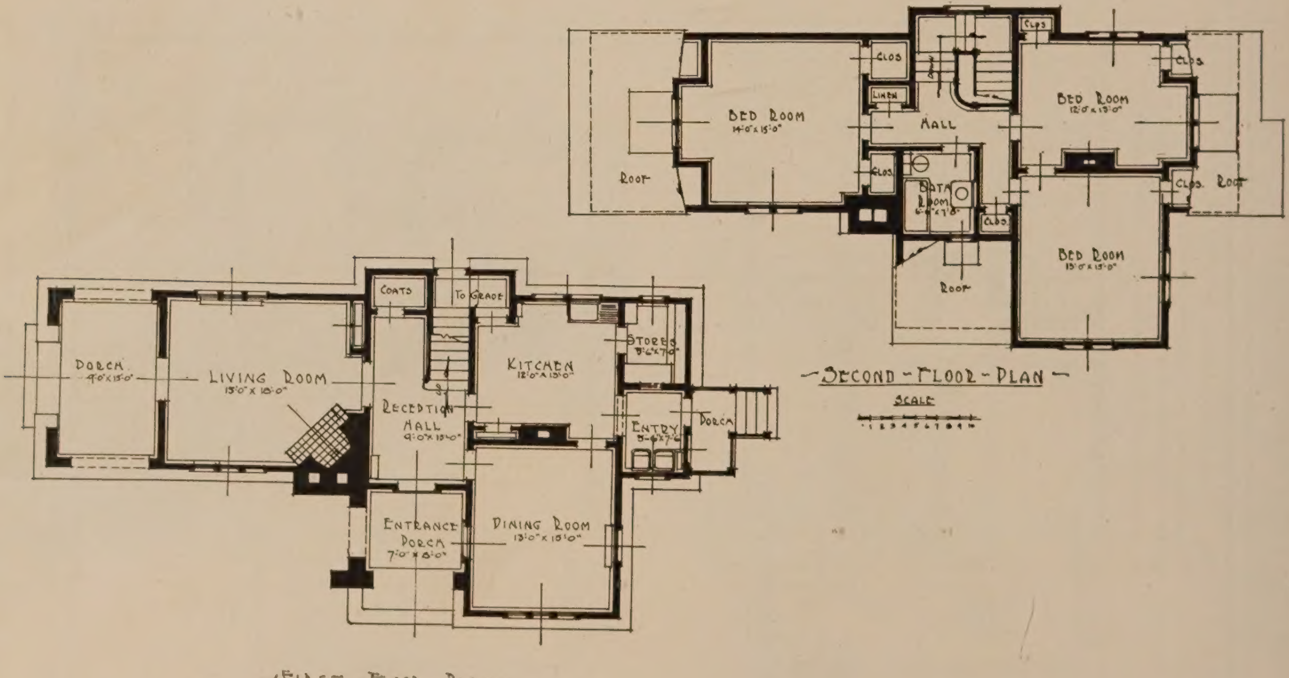


The building is executed in frame construction, widely used and most economical in cost. It is diagonally sheathed with 3/8″ tongued and grooved sheathing which help materially to strengthen the exterior walls. Over these is placed a double layer of building paper upon which is laid wood siding 10″ to the weather. This siding is very attractive. The architect has designed the building with a gambrel roof, bringing the lines of the roof with a graceful overhang above the first-story windows and around three sides of the house, thereby relieving the usual monotony of a house built on a square plan. The gambrel roof permits the installation of an attic story, with two chambers and a bathroom to be used either for guests or servants. They give the impression that the building is actually three stories high.


Attic Plan
Scale 1/4" = 1'-0"
Chamber
Wood Fl.
Hall
Wood Fl.
Bath Rm.
Bath
Cellar Plan
Scale 1/4" = 1'-0"
Coal Bin
Store Room
Boiler
Unexcavated
5" Concrete Floor Slab 1" Cement Finish
Samuel A. Heltz R.A.
Architect
14 Maiden Lane New York


Second Floor Plan
Scale 1/4" = 1'-0"
Chamber
Parquet Floor
Hall
Closet
Bath Rm.
Canvas Roof
First Floor Plan
Scale 1/4" = 1'-0"
Kitchen
Wood Floor
Dining Room
Parquet Floor
Hall
Living Room
Sun Parlor
Samuel A. Heltz R.A.
Architect
14 Maiden Lane New York





COTTAGE AT MOUNT KISCO, N. Y.

Morrell Smith, Architect.

In construction the house is of frame with exterior walls of light-gray stucco with a rough-cast surface. The foundation-walls, chimneys, porch columns, etc., are constructed of field stone taken from the adjacent fences on the property. The roof is shingled with 24-inch cedar shingles, which are laid in wide courses at the eaves and gradually diminishing in the spacing to the weather as the ridge is approached. All exterior wood trim will be stained a rich brown color and the roof-shingles a moss green. The interior treatment is very simple. All interior woodwork will be painted white and the floors, which are of comb grain N. C. pine, will be stained and waxed. The house will be heated with a steam-heating plant and will be equipped with electric-lighting fixtures, screens, etc. The house will cost approximately $11,000.

Editorial and Other Comment

Luxuries vs. Homes

RECENT editorials in two great metropolitan newspapers, one in the East, the other in the West, dealing with the subject of the shortage of material in the building trades, dwelt at considerable length upon the diversion of enormous quantities of metal and glass for use in industries that come under the head of luxuries. The demand has been so great as to affect very seriously the supplies available for use in building. Emphasis is laid also on the thousands of laborers engaged in the trades associated with building who have transferred their services to industries that are more or less given to the production of what may be considered luxuries.

Our own building problem has been also the subject of serious inquiry in Europe, and it is becoming more and more a dangerously critical problem. There seems to be abundant capital for the building of great factories, all kinds of industrial buildings, great office-buildings, and the transformation of thousands of old-fashioned houses into places for business use. In the meantime there is growing every day an increasing shortage of places where people may live in all of our cities. A place to live within easy access of their places of employment is becoming practically impossible for thousands, and the adjoining suburbs within commuting distance of the city are already overcrowded. It does seem as though some immediate united and heroic effort should be made to use every possible resource toward the question of housing development. The present too often unscrupulous and unreasonable boost of rentals, not only in the matter of living places but in offices, it would seem must reach a limit before long.

From London we hear "that a crisis in the building trades has been reached, and that the London County Council has been obliged to stop all building except residences, under the powers granted by the Health Ministry, to overcome the housing shortage. Dry-goods stores, office-buildings, and other construction have to wait because the demands of housing are so great."

There are already signs made known in recent despatches, from the West especially, that the era of reckless spending for luxuries is nearing an end, and the sooner it does the better, and perhaps some of the money that has been used in this way with nothing to show for it can be diverted in the way of investments in new housing construction. There are hundreds of architects who have in mind thoroughly practical ideas for extensive housing schemes that need only the encouragement of capital to be developed successfully. Certainly it is high time to make a searching investigation of the conversion of building essentials into the manufacturing of things that are not vitally necessary in the ordering of the average life.

The Chicago *Tribune* says: "When mahogany is used for talking-machines, it is not so bad, because we can build without mahogany if necessary, but when metal that could be converted into necessary gutters, flashings, plumbing, and fire-resisting lath, or rubber and asphalt that could be converted into roofing, are used in the manufacture of luxuries to such an extent that the national living conditions are at stake, the matter becomes of public concern, and the construction industry must be welded into one compact organization to deal with the situation."

Give the Architect His Due

WE are in receipt of an interesting letter from a well-known architect, calling our attention to some misinformation contained in a more or less popular handbook dealing with the history and development of the city of New York. The quotations would be amusing if they were not so exasperatingly lacking in any sense of knowledge, accuracy, or respect for the truth. The proper attribution of the name of an architect of a great monumental building should be as important and as carefully authenticated as the name of the painter of a famous picture. The genius and skill of the architect of distinction is usually writ large in his work to the knowing observer, but to the average man in the street his creation is probably merely known as the office of such and such a trust company, such and such a court-house, or perhaps the residence of a multimillionaire, or mayhap a library or a museum. No one with even a mild interest in pictures or sculpture but finds added interest in being able to associate a particular work with the name of the artist. Visitors to our galleries take pride in their ability to talk of this and that painter and to be able to identify the work by the same artists when exhibited elsewhere. The same interest should apply to the work of the architect.

"The fact that architecture is first an art and secondly a science, and should be taught primarily as an art," is one of the chief considerations as announced in the prospectus of the new school of architecture at one of our greatest universities. If the position of the architect and his work are not more widely appreciated, it is because so few of their names are associated in the public mind with their representative work. The average layman probably thinks of a building first in questions of commercial terms—does it pay? Is it a good business proposition? Is it up to date in all its modern conveniences? Many of our great financial institutions have realized the advertising value not only of buildings that are notable for their mere size, but as well for their dignified exteriors and luxurious and beautiful interiors, that make them notable and distinguished from the great mass of buildings that surround them.

The question has often been discussed as to whether the architect should sign his work, and in a number of instances the architect's name appears in a more or less prominent place in or on the building he has created. From the letter which has prompted this, with thanks to the architect, we quote the following illuminating paragraphs:

"At No. 52 Broadway, below Wall Street, stood until recently a building of more than ordinary interest—the first Successful Skyscraper erected in New York (1884). It was only eight stories high, but will tower historically higher than any building that will ever stand on the Island; it demonstrated the feasibility of skeleton steel construction and caused Manhattan to develop up into the air instead of along the ground. Bradford Lee Gilbert, the architect whose genius gave to New York and the World this remarkable type of building, in telling the story to friends, said that the idea of an iron building had come to him in a dream."

Of the Municipal Building, "it is striking architecturally, and its massive sculpture is very impressive."

"Critics go in raptures over Doctor Parkhurst's Church and point out its many artistic qualities. All this may be art, but for a sacred edifice it is the most frivolous-looking structure ever conceived by the mind of man. For a Movie house it would be fine. The site has recently been purchased by the Metropolitan, and this Burlesque on religion will be removed, for which much thanks."

"With a sigh one recalls the sudden death by accident of the great architect whose brain planned this classic edifice (The New York Public Library) just a week before its formal opening. The doors of the still unopened building swing back to permit the body of John M. Carrerre to rest for a moment in the rotunda of what was to be the crowning achievement of his career. It was a graceful and beautiful tribute."

"At 96th Street is the Cliff Apartment House. Above the second elevation is a frieze in low relief, carrying out symbolically the mountain lions, rattlesnakes, buffaloes' skulls and other local environments of a genuine cliff dwelling in Arizona. It is a clever idea and never fails to attract attention."

We hope this will not seem trivial to our readers, but if stuff of this sort goes into one popular guide that, no doubt, accompanies many visitors that travel about in our sightseeing busses, other similar misinformation is, no doubt, available.

Council of Architectural Registration Boards

DURING the recent Institute convention at Washington it was decided to form a permanent organization to be known as the Council of Architectural Registration Boards, with Professor Emil Lorch, of the Michigan State Board, as president, and Emory Stanford Hall, president of the Illinois State Board, as secretary. The primary purpose of the organization is to bring together the experience of those actually engaged in the work of registration, to make a comparative study of all existing laws, and to work out a plan to facilitate reciprocity between States having such laws. Mr. W. P. Bannister, of the New York State Board, Mr. W. H. Lord, of North Carolina, and Mr. M. I. Kast, of Pennsylvania, together with Mr. Richard E. Schmidt, chairman of the Institute committee on registration laws, are to make a digest of the various laws.

All those interested in this work should write Mr. Hall, Secretary, 64 East Van Buren Street, Chicago, Illinois.

To Assist in Home Building

THE "instalment mortgage" is one of the features growing out of the shortage of homes. Its inauguration is due to the efforts of some of the large industrial concerns in Chicago and other cities to promote the interests of their employees. The shortage of homes adds not only to the financial burdens of many classes of people, but has a general disturbing effect that fosters unrest and a decrease in production.

In one of the plans involved the employees are to make an initial payment of 10 per cent of the cost of the home, and then pledge themselves to pay the balance in monthly instalments covering a period of ten years, the total cost being just what the cost has been to the corporation. It is believed that such plans can not fail to have a helpful effect on general industrial conditions, for nothing has a more stabilizing influence on those who perform the country's work than adequate and comfortable homes.

During the first four months of the present year more than one-half of the total valuation of new construction work has been for industrial and business buildings. While there is great need for these, there is a vital necessity that a larger percentage of the nation's building activities should be directed to the construction of homes. Only about 20 per cent of the total construction of the country so far in 1920 has been given to home building, which is at least 10 per cent below normal.

Book Reviews

"WESTMINSTER CATHEDRAL AND ITS ARCHITECT." By WINEFRIED DE L'HÔPITAL. With an Introduction by PROFESSOR W. R. LETHABY, F.R.I.B.A. Two volumes with 160 illustrations, including some in color. Dodd, Mead & Company, New York.

It would be difficult to find two great churches more widely contrasted or more typical from a stylistic point of view than Westminster Abbey and Westminster Cathedral—one a splendid example of English Gothic, the other a modernized version of the Byzantine.

This great Roman Catholic cathedral in London is built on the site of the old Middlesex County Prison of Tothill Fields, a part of the land of the Abbey of Westminster.

Begun under Cardinal Manning and carried on by Cardinal Vaughan, the cathedral has been a source of pride and labor of love to all concerned. Westminster Cathedral, as first conceived by the architect—John Francis Bentley—was to carry on the traditions of the Gothic, but after an extended journey in Italy, where he made an enthusiastic study of the churches of Byzantine type, he returned full of a new purpose and new ideals that expressed themselves in Byzantine terms.

This record of the prime achievement of a life, written by the architect's daughter, Winefried de L'Hôpital, is first of all a fine human document. In its narrative is revealed the architect's beginnings, his intense love for art as a boy, his interest in the work of the local joiners and carvers. His education was that of so many men who have distinguished themselves in the arts, the education founded on natural inclinations, and in doing things he loved. For a time he was a pupil of Henry Clutton.

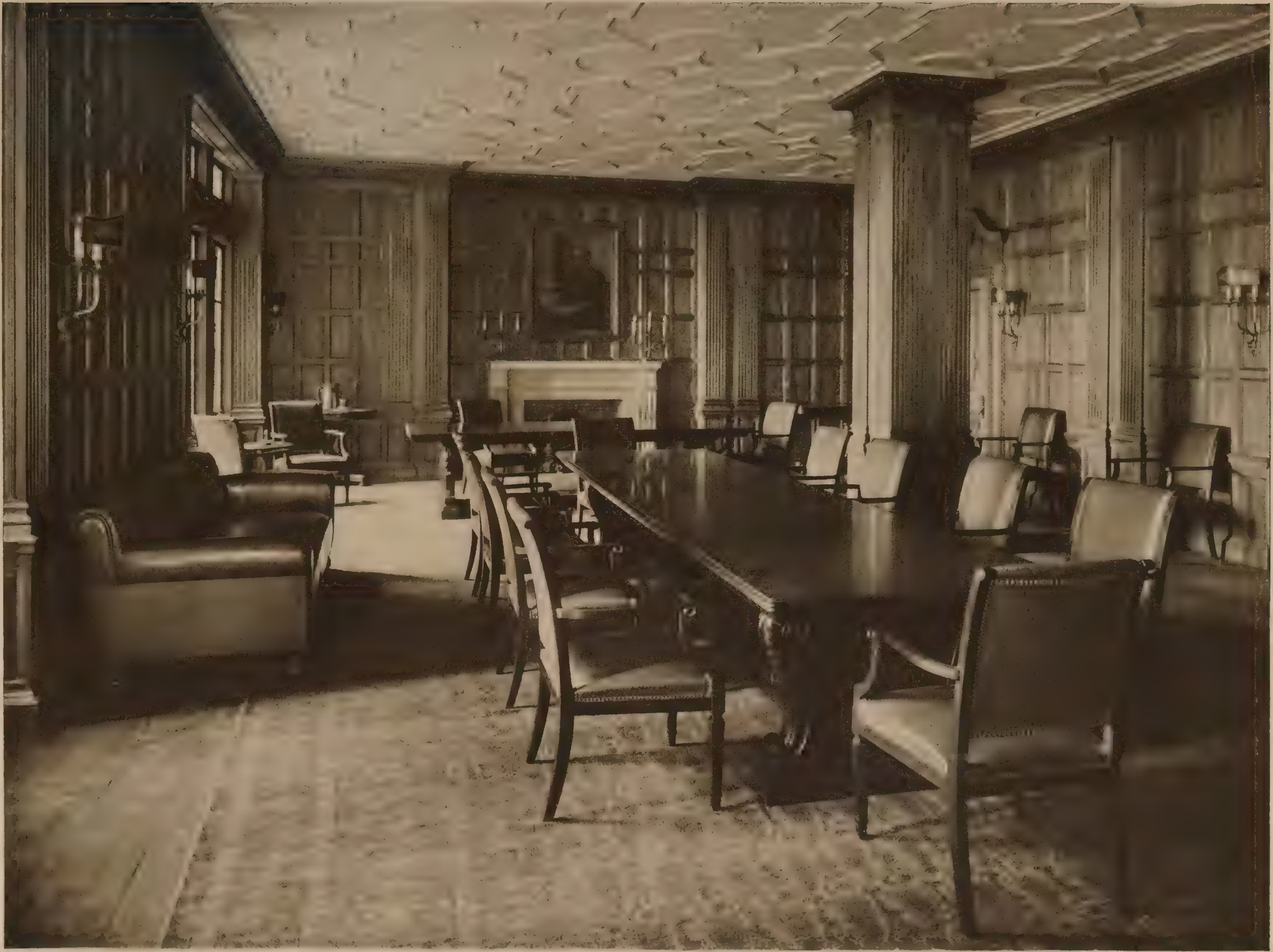
In volume I is told fully the story of the building of the cathedral from the ceremonies attending the laying of the foundation-stone. Each development of the work is dwelt upon in considerable detail, and includes full descriptions of the architectural problems involved and the various materials used. The illustrations show plans and cross-sections, as well as many plates from photographs of details of both exterior and interior.

No matter what may be the first impression of the exterior of the cathedral, and it may at first strike the casual observer, especially in its contrast with Westminster Abbey, as an unusual conception of the modern Christian church, there is no denying that it grows more impressive with further study, and that the richness of color of the interior is strikingly beautiful and impressive. The love of color and the design of the East are manifest on all sides.

Bentley lived only to see the shell of his dream realized, but he knew that his work was to go on and live after him. From 1860 to 1870 he had become well known as an architect associated with ecclesiastical commissions as well as domestic architecture, and he was widely known as a skilful designer of stained glass, metal work, and ecclesiastical furniture.

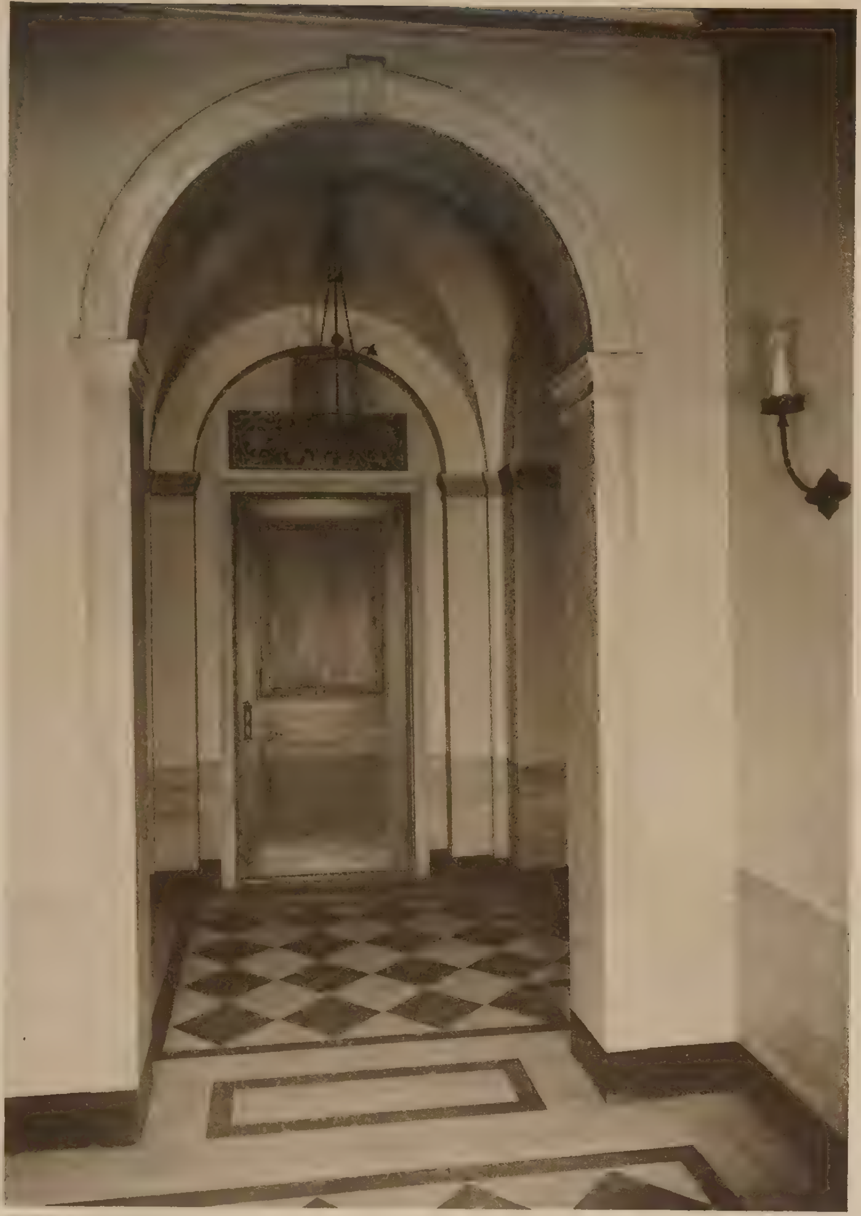
It is of especial interest to American readers to know that he visited the United States in 1898 at the request of the Bishop of Brooklyn, to give advice with regard to a proposed cathedral in that borough, and that he made drawings for a fine Gothic church 350 feet in length, with two western towers.

Bentley, never robust in health, died at the age of 63. In the great church associated with his name he put himself, his very body and soul.

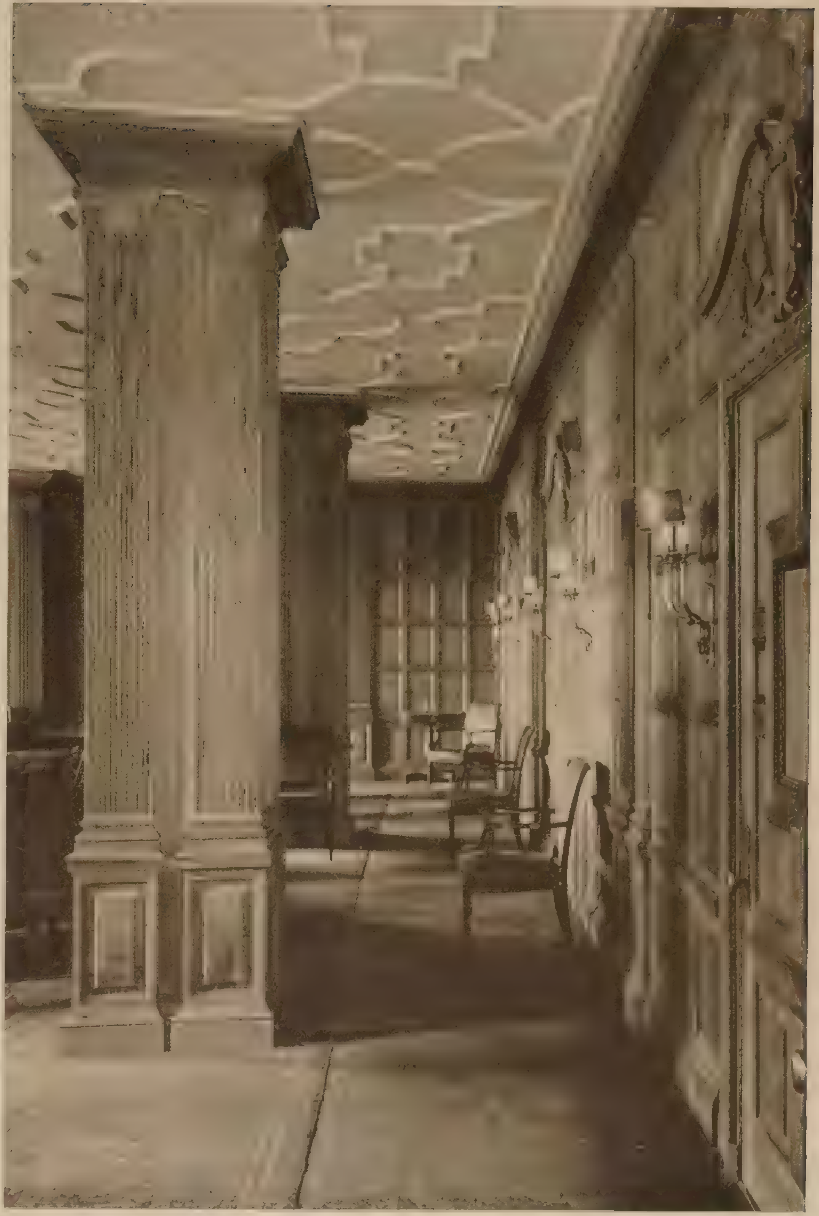


DIRECTORS' ROOM, PRIVATE OFFICES, CENTRAL UNION TRUST CO., NEW YORK.

Arthur Loomis Harmon, Architect.



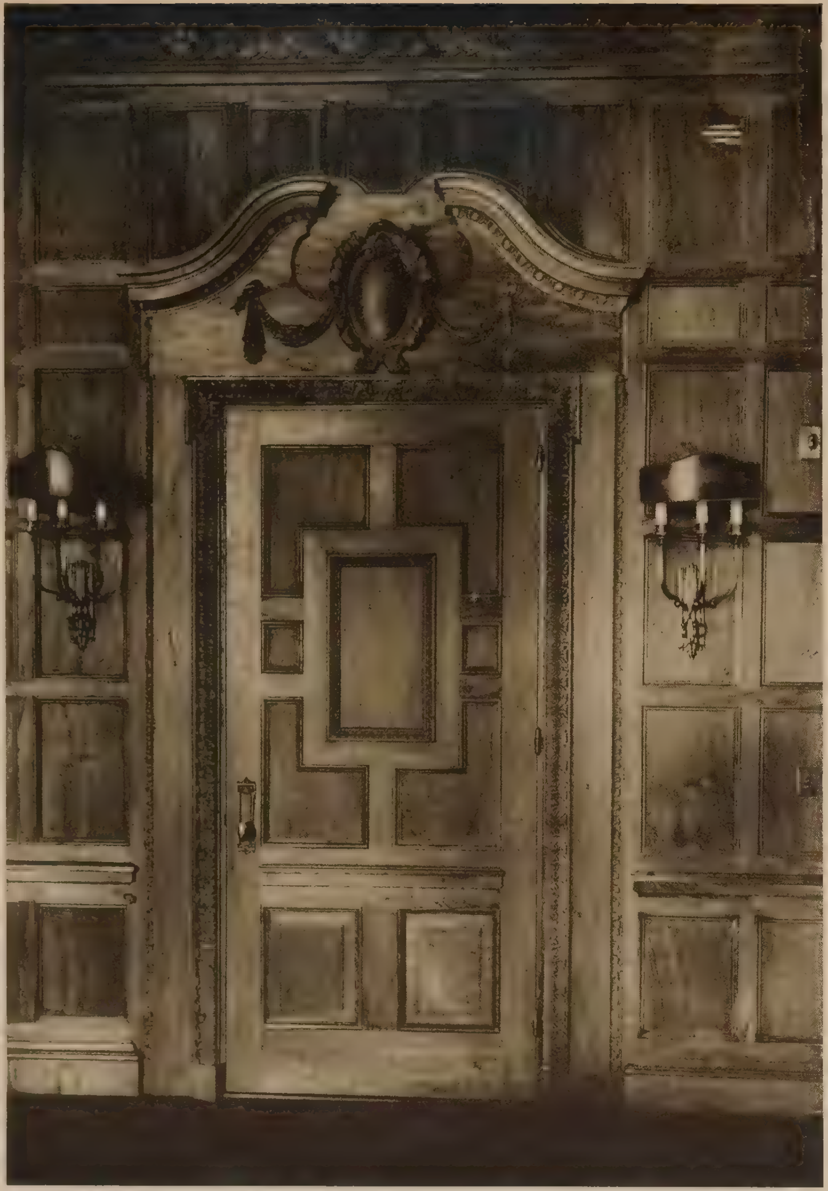
ENTRANCE HALL.



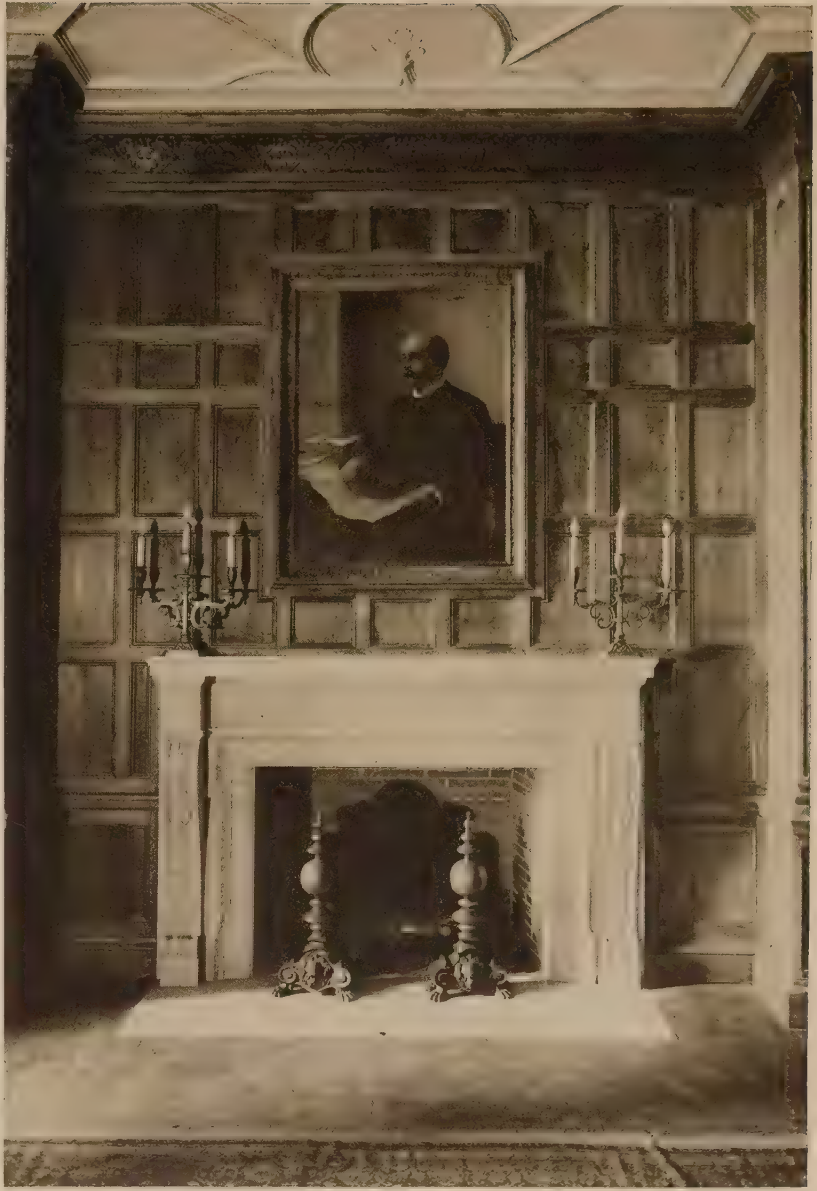
DETAIL IN DIRECTORS' ROOM.

Arthur Loomis Harmon, Architect.

PRIVATE OFFICES, CENTRAL UNION TRUST CO., NEW YORK.



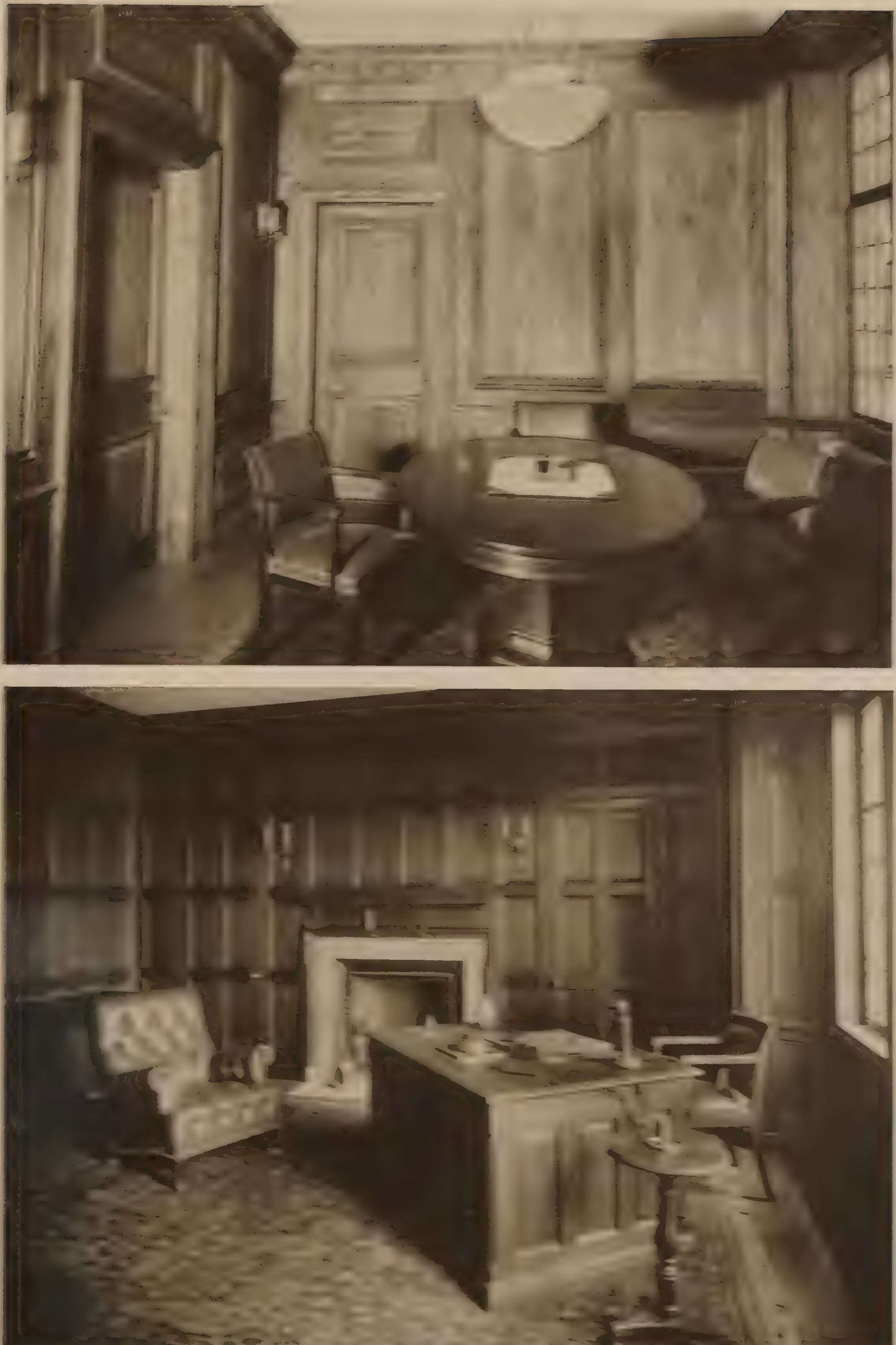
DOORWAY TO PRIVATE OFFICE.



MANTELPIECE, DIRECTORS' ROOM.

Arthur Loomis Harmon, Architect.

PRIVATE OFFICES, CENTRAL UNION TRUST CO., NEW YORK.



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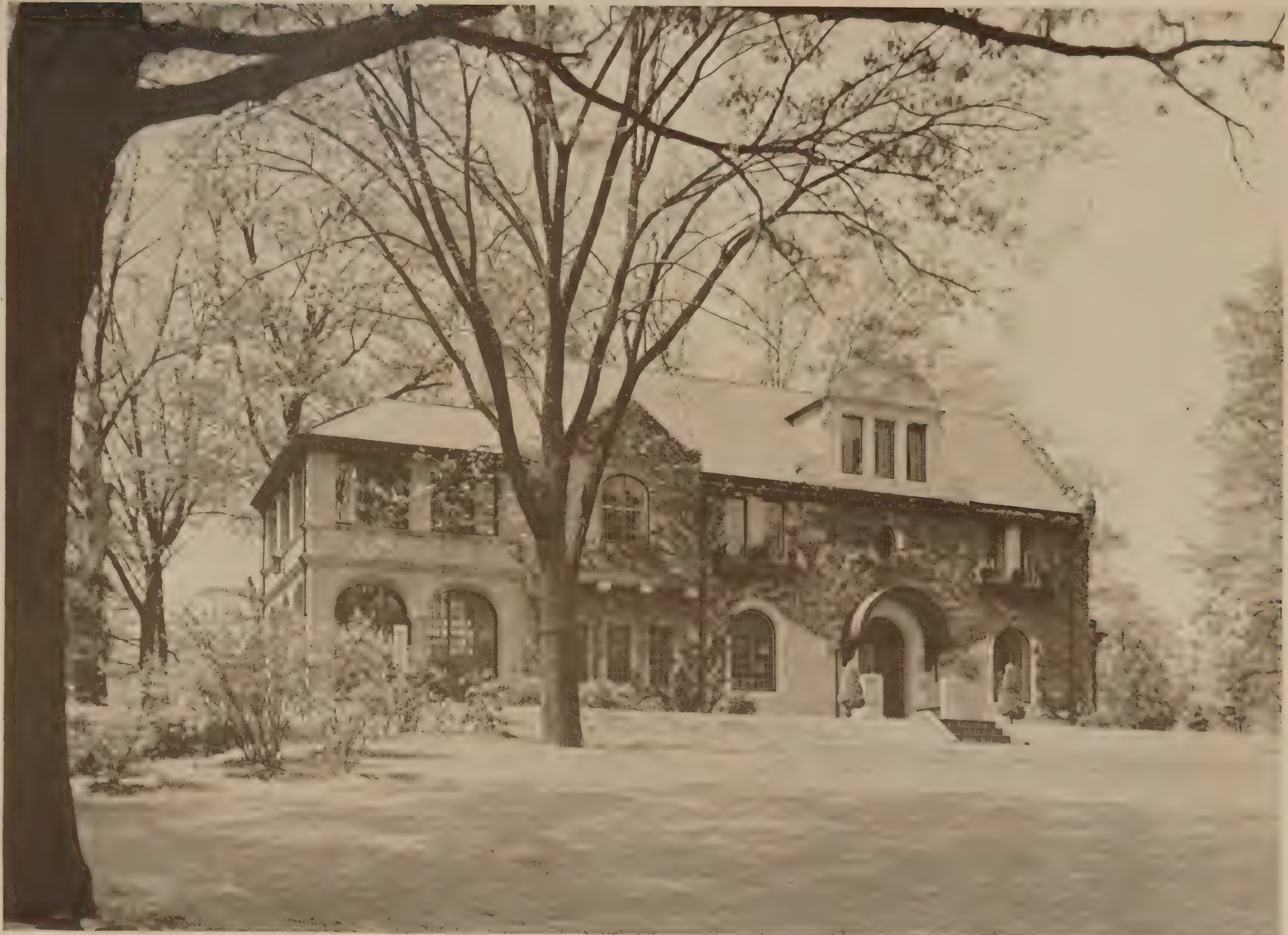
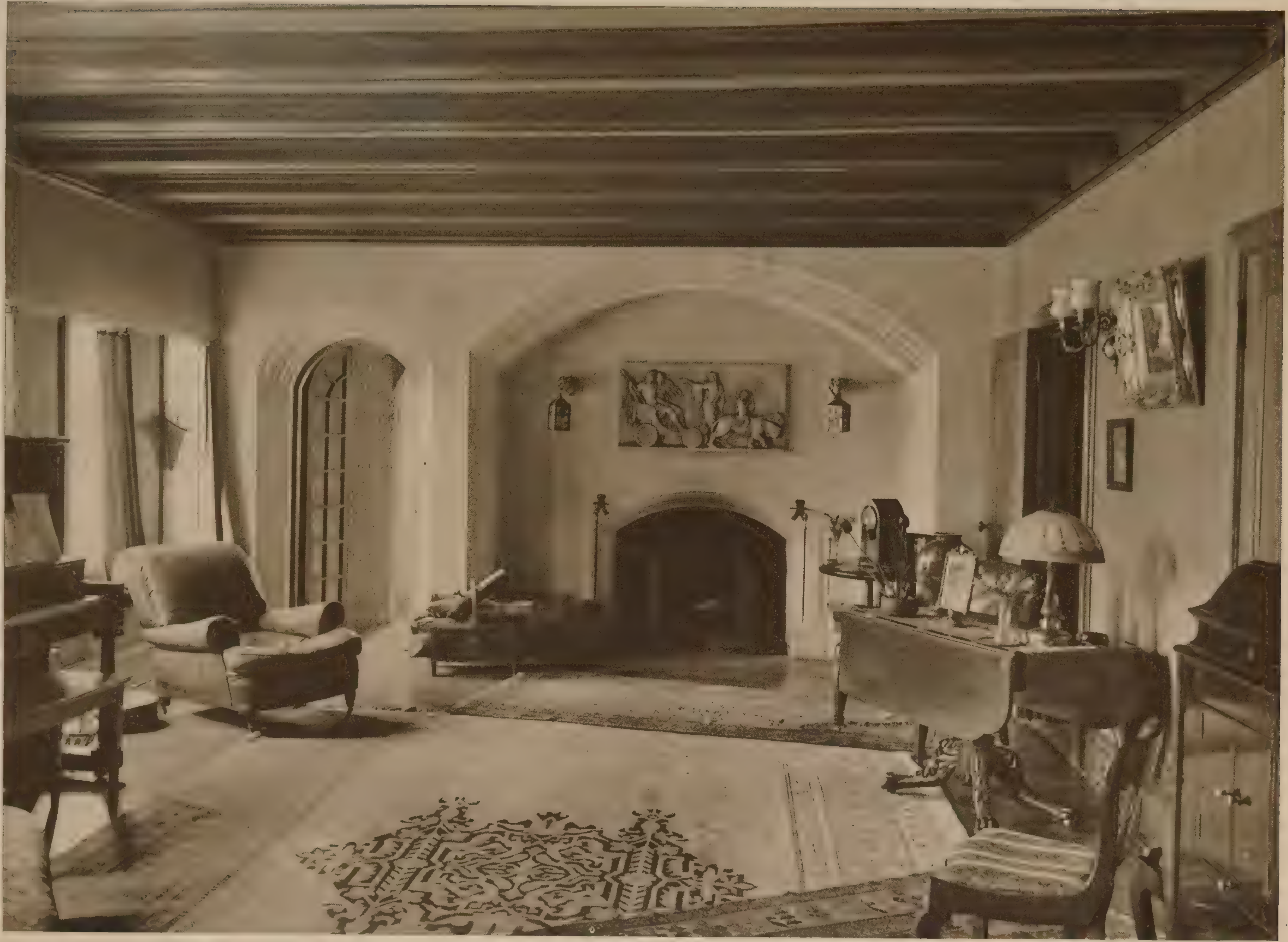


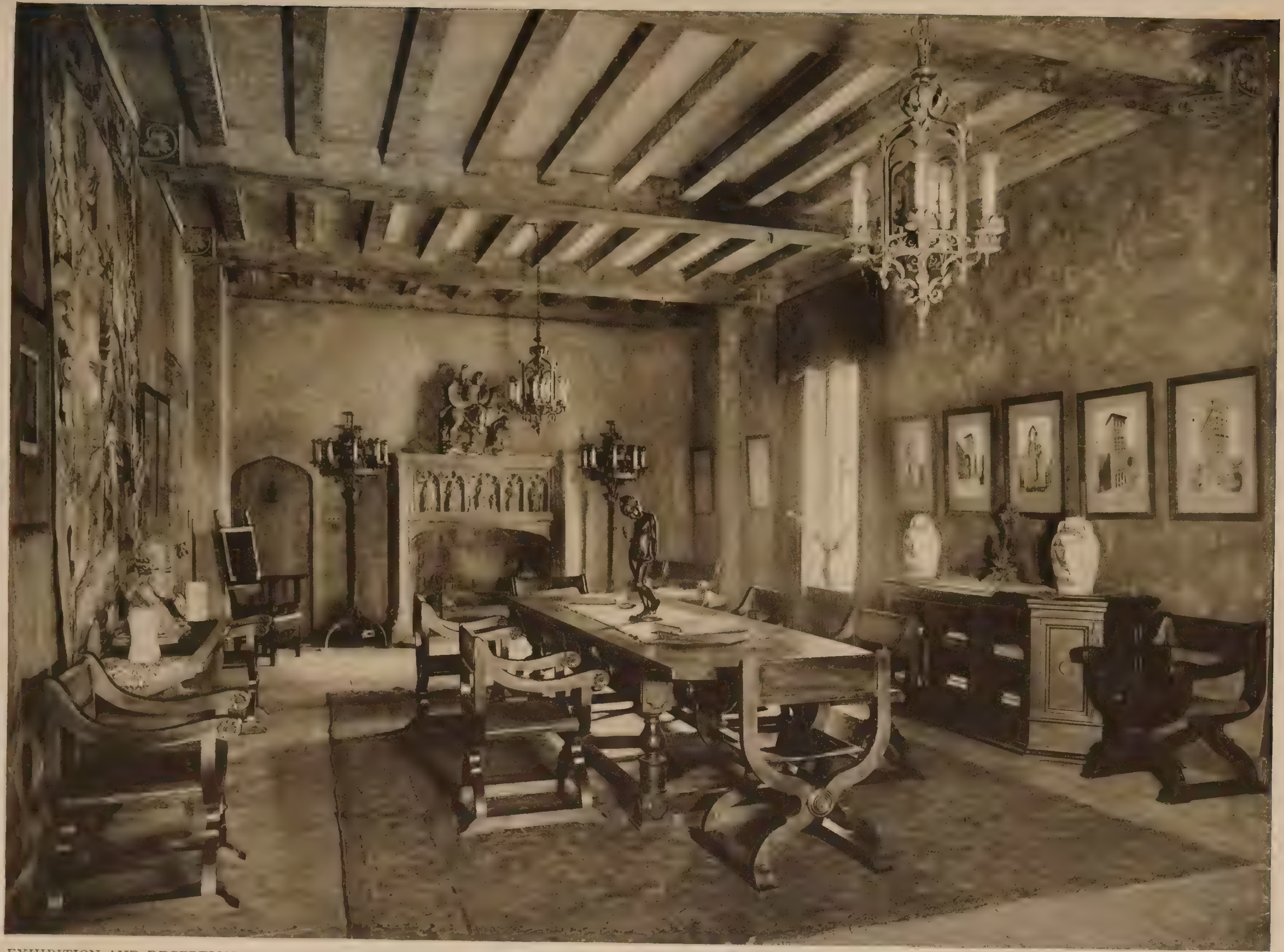
RESIDENCE, REGINALD FOSTER, RIDGEWOOD, N. J.

Tracy & Swartwout, Architects.



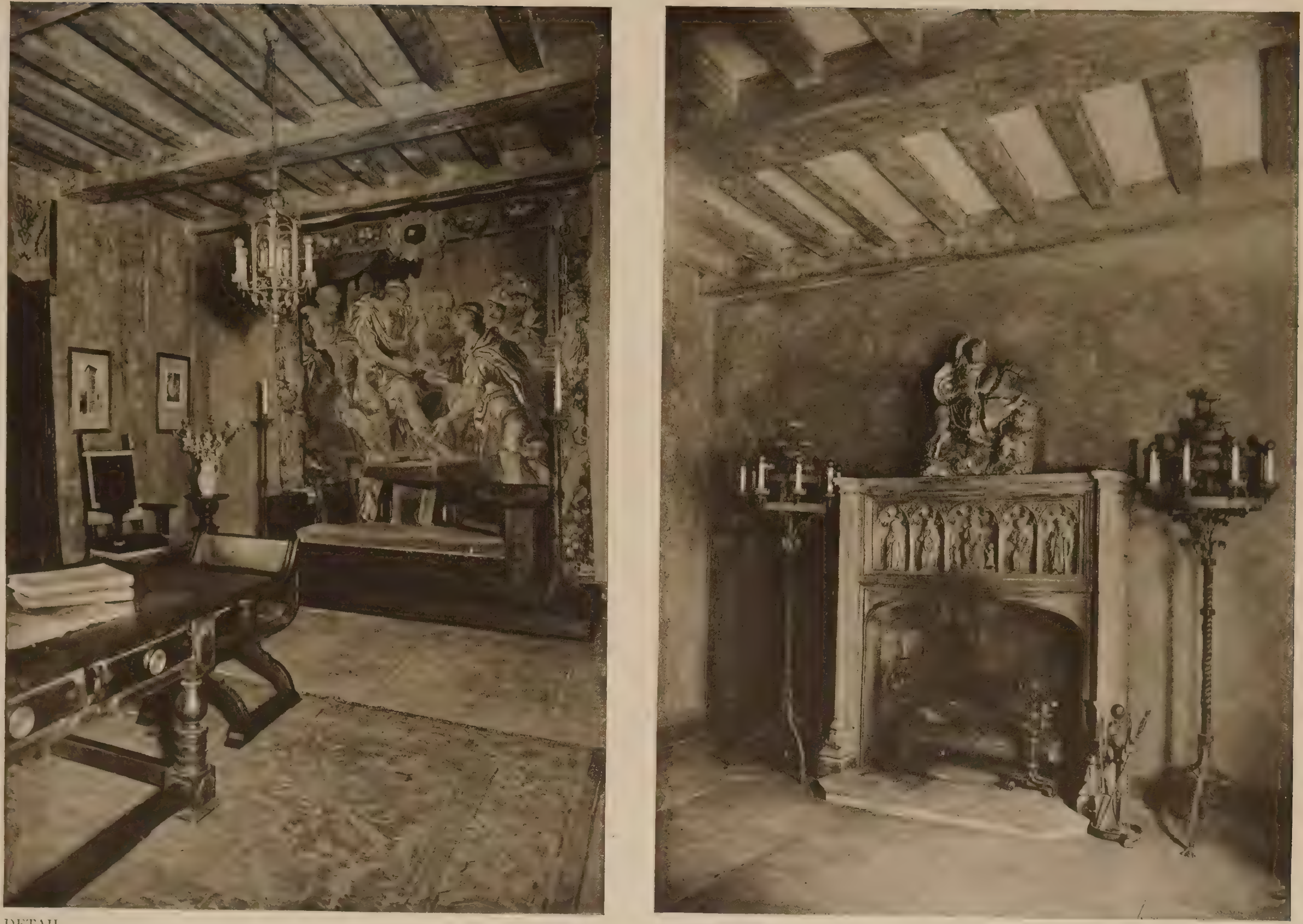
LIVING-ROOM, RESIDENCE, REGINALD FOSTER, RIDGEWOOD, N. J.

Tracy & Swartwout, Architects.



EXHIBITION AND RECEPTION ROOM, OFFICES OF ALFRED C. BOSSOM, 680 FIFTH AVENUE, NEW YORK.

Alfred C. Bossom, Architect.

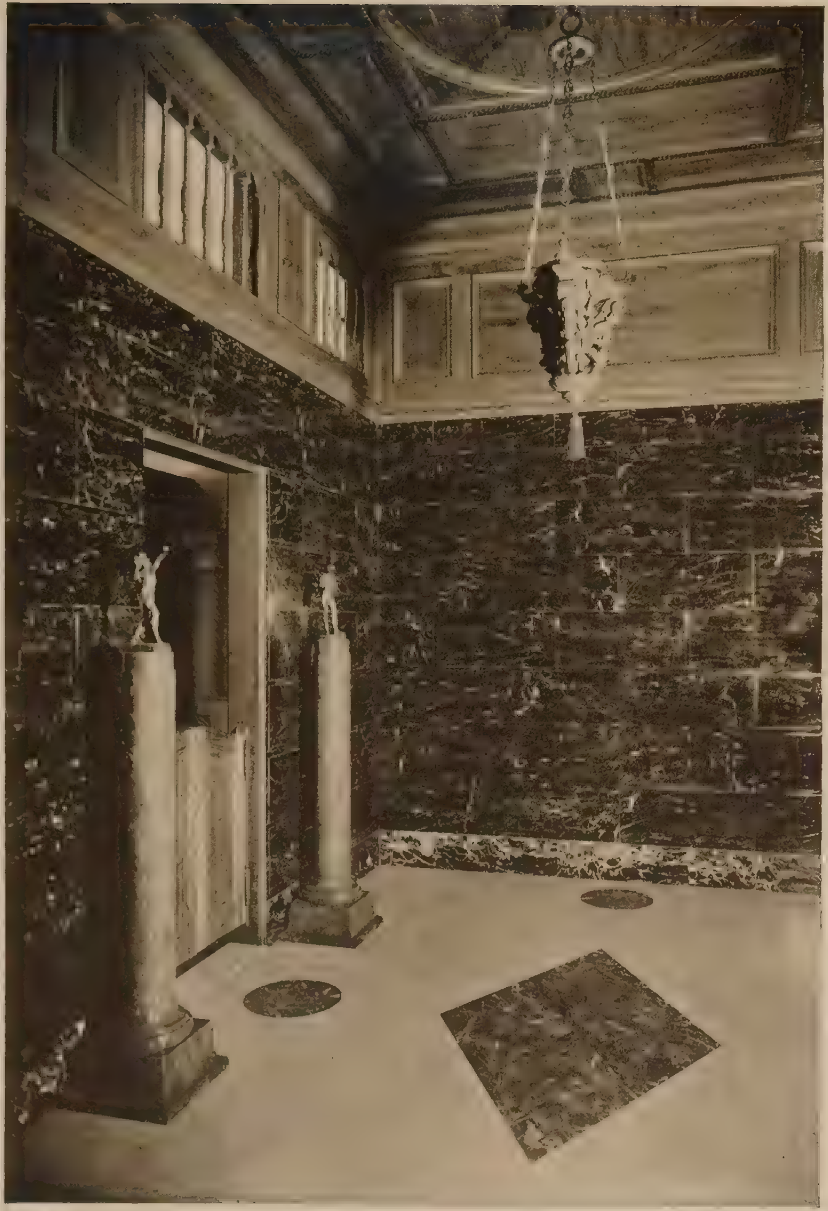


DETAIL.

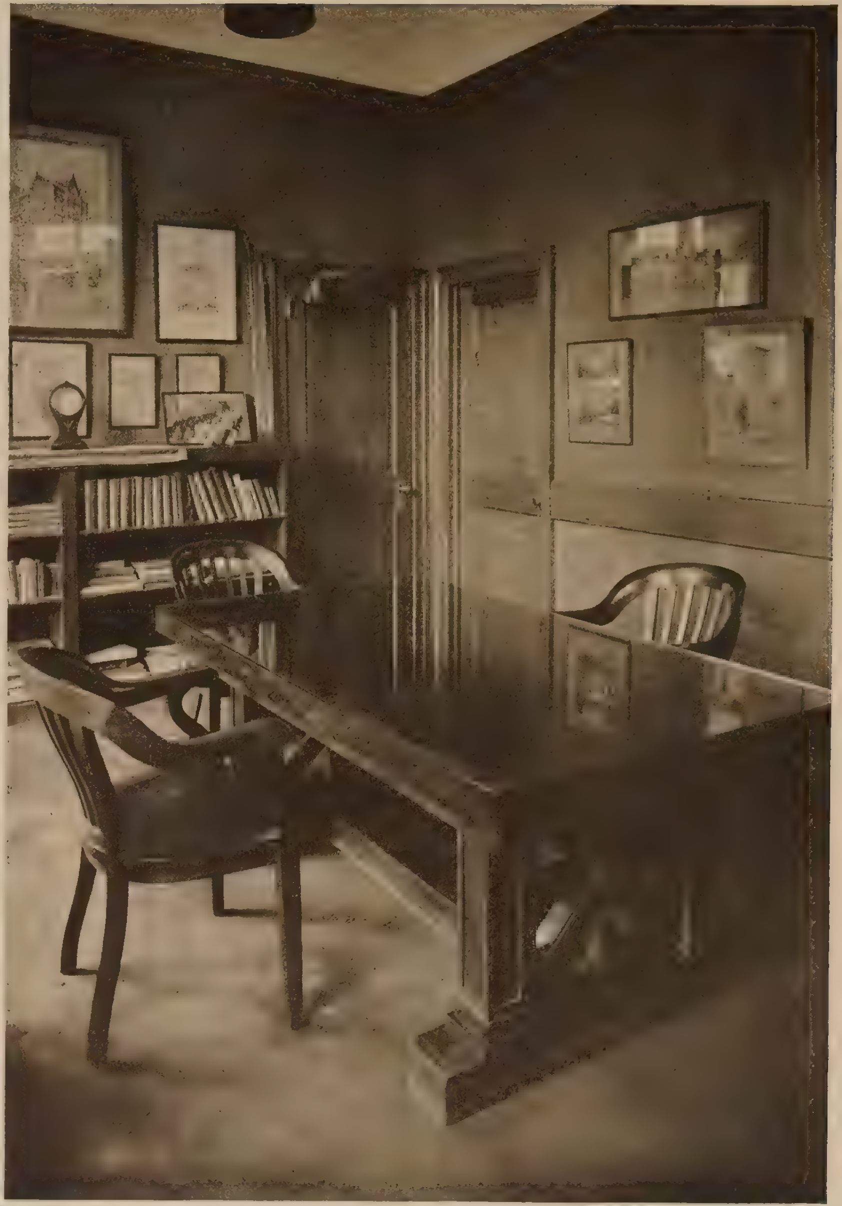
MANTEL.

Alfred C. Bossom, Architect.

EXHIBITION AND RECEPTION ROOM, OFFICES OF ALFRED C. BOSSOM, 680 FIFTH AVENUE, NEW YORK.



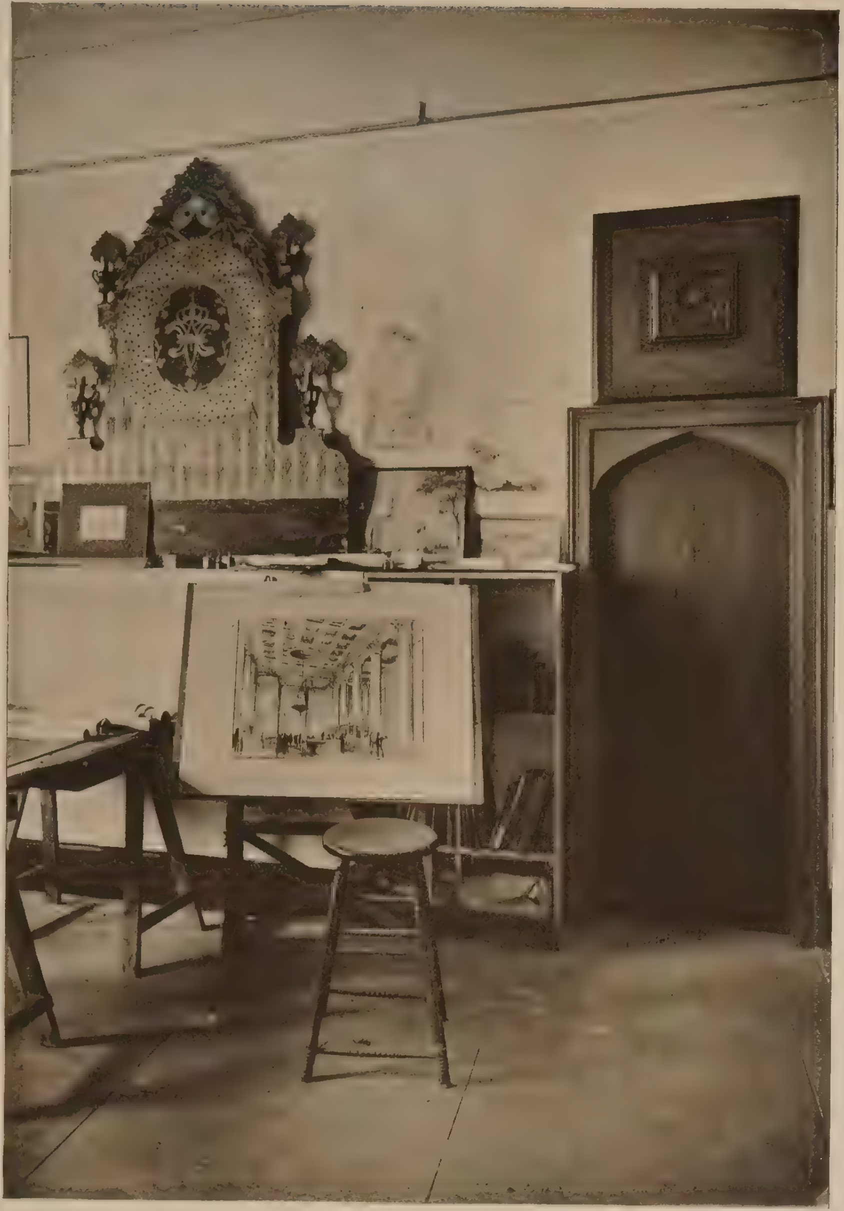
LOBBY.

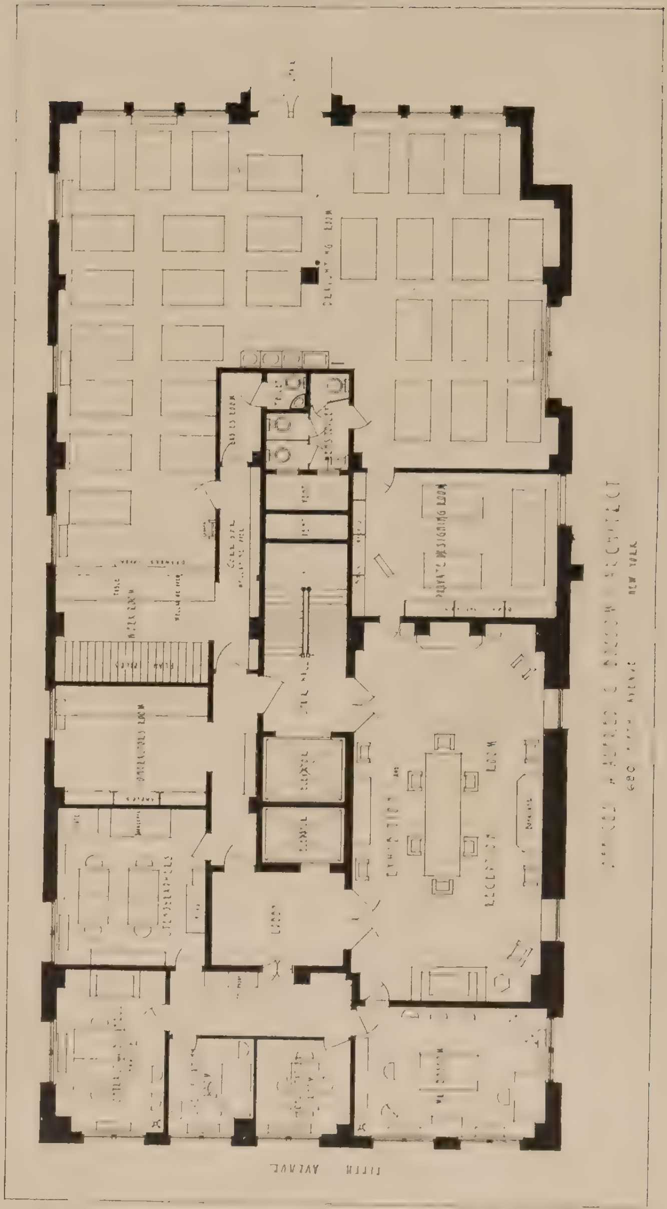


MR. BOSSOM'S ROOM.

Alfred C. Bossom, Architect.

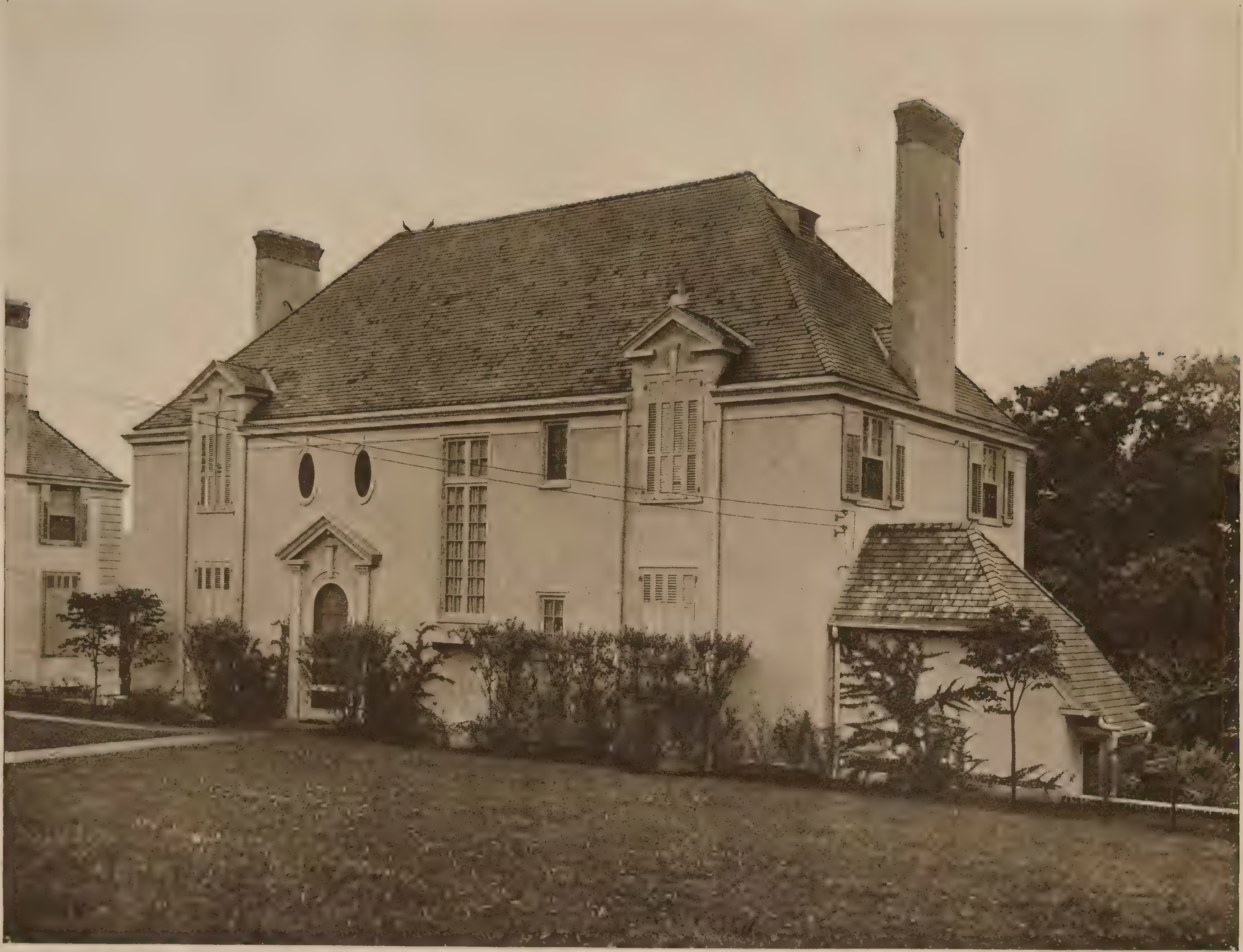
OFFICES, ALFRED C. BOSSOM, 680 FIFTH AVENUE, NEW YORK.




OFFICES OF ALFRED C. BOSSOM ARCHITECT
680 FIFTH AVENUE NEW YORK
DRAFTING ROOM
PRIVATE DESIGNING ROOM
RECEPTION ROOM
FIFTH AVENUE

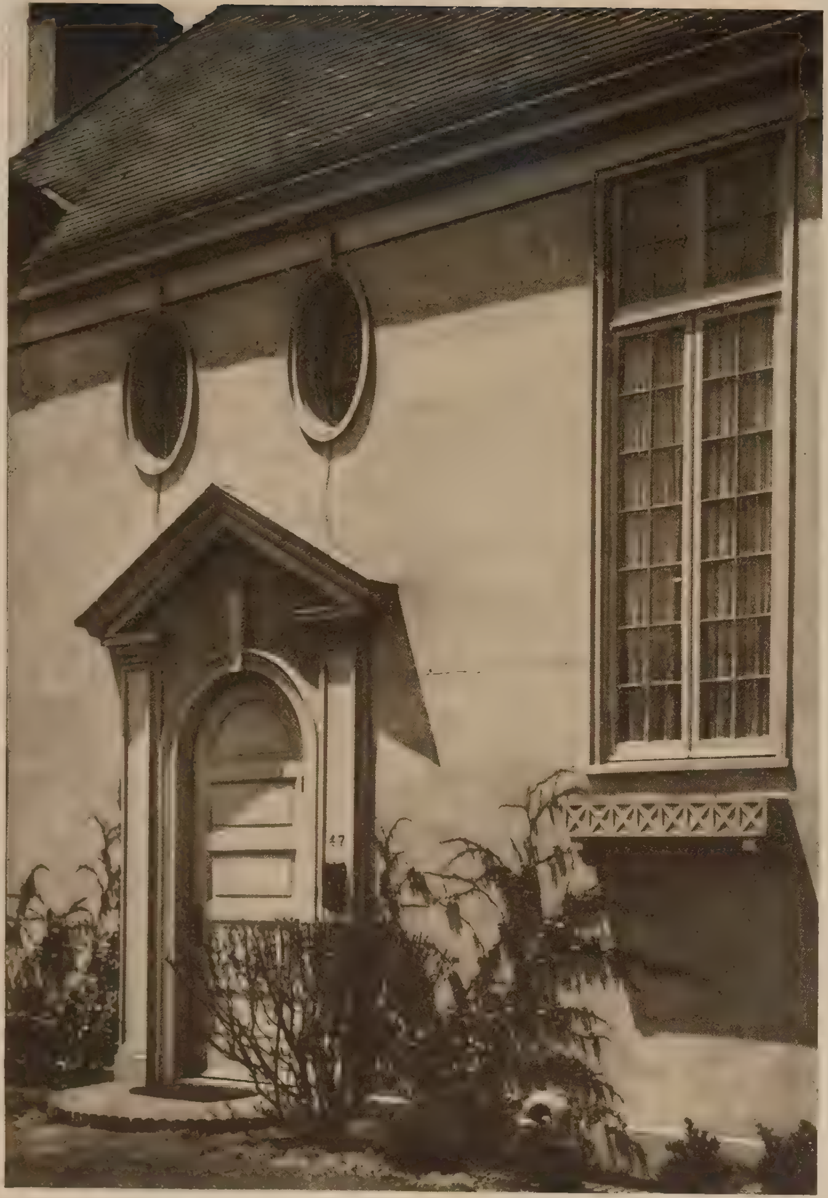
PRIVATE DESIGNING-ROOM, OFFICES OF ALFRED C. BOSSOM, 680 FIFTH AVENUE, NEW YORK.

Alfred C. Bossom, Architect.

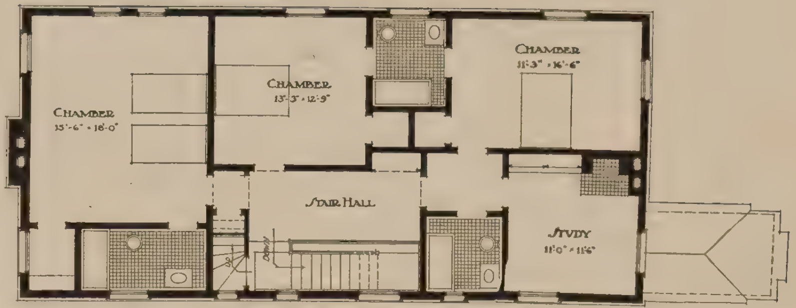


RESIDENCE, E. W. FOWLER, HARTSDALE, N. Y.

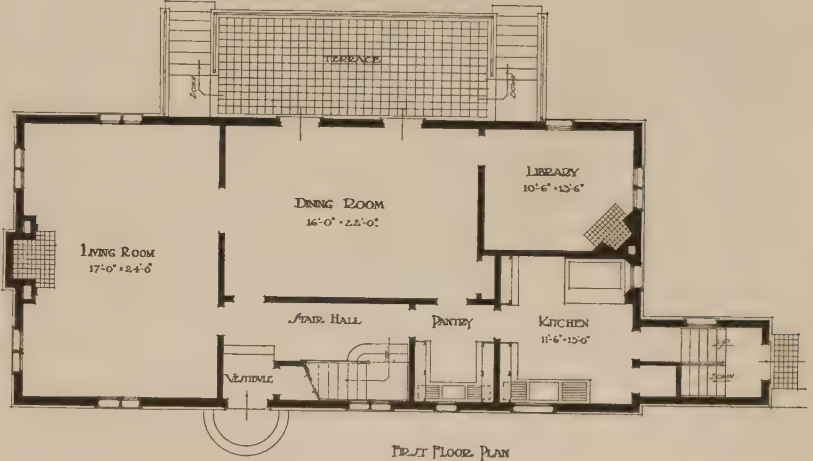
Eugene J. Lang, Architect.



ENTRANCE DETAIL, RESIDENCE, E. W. FOWLER, HARTSDALE, N. Y.

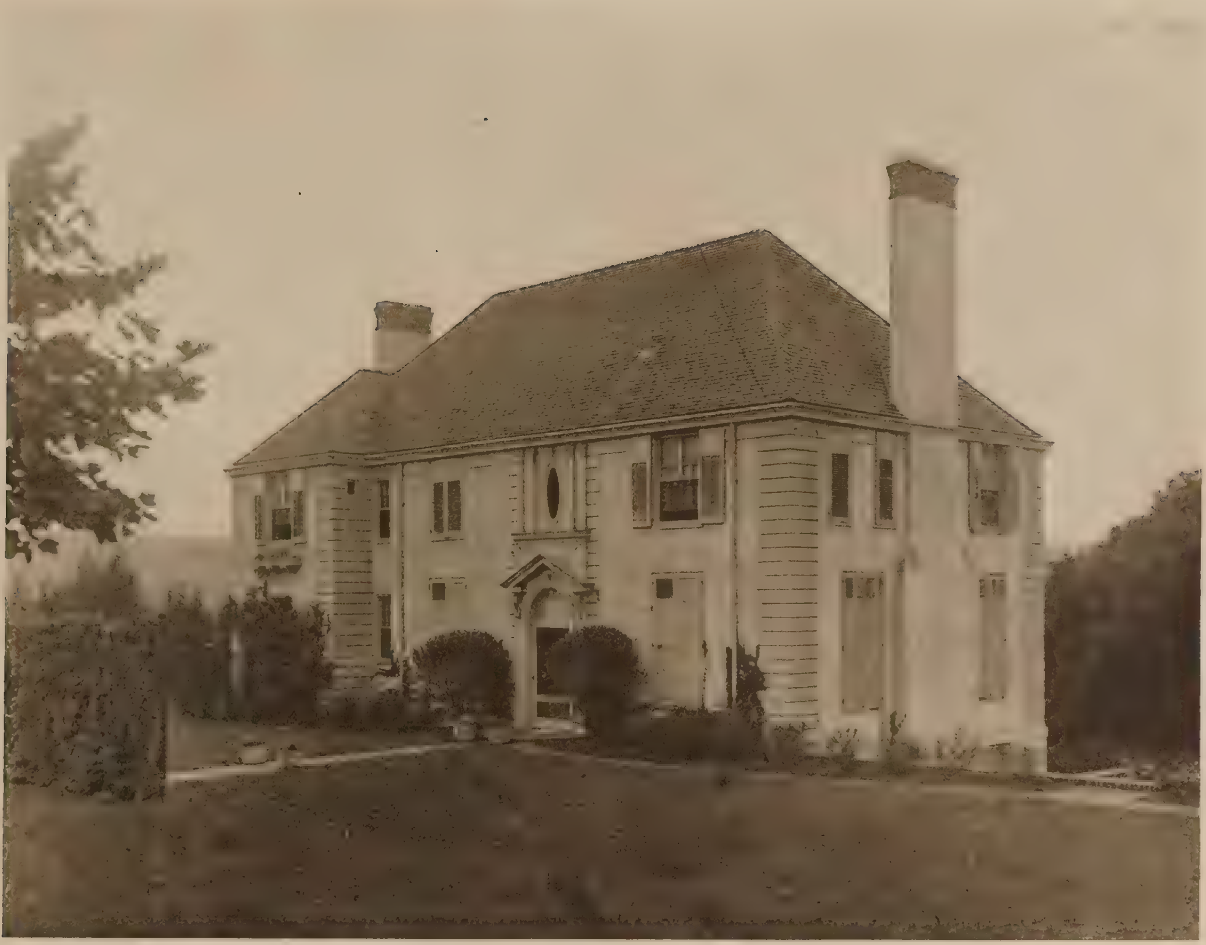


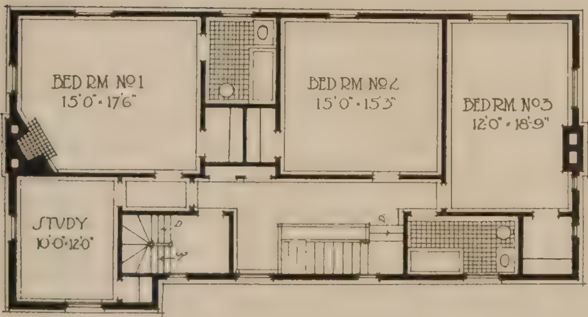
Second Floor Plan

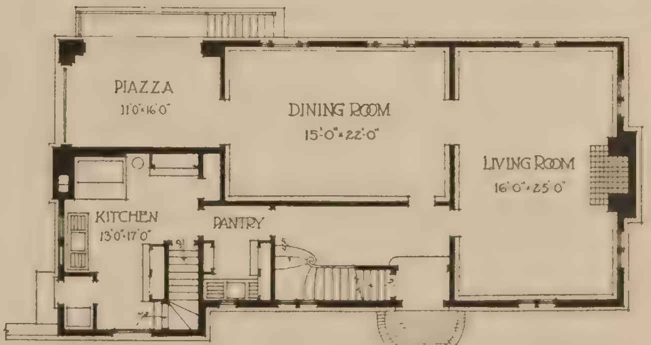


First Floor Plan

Eugene J. Lang, Architect.

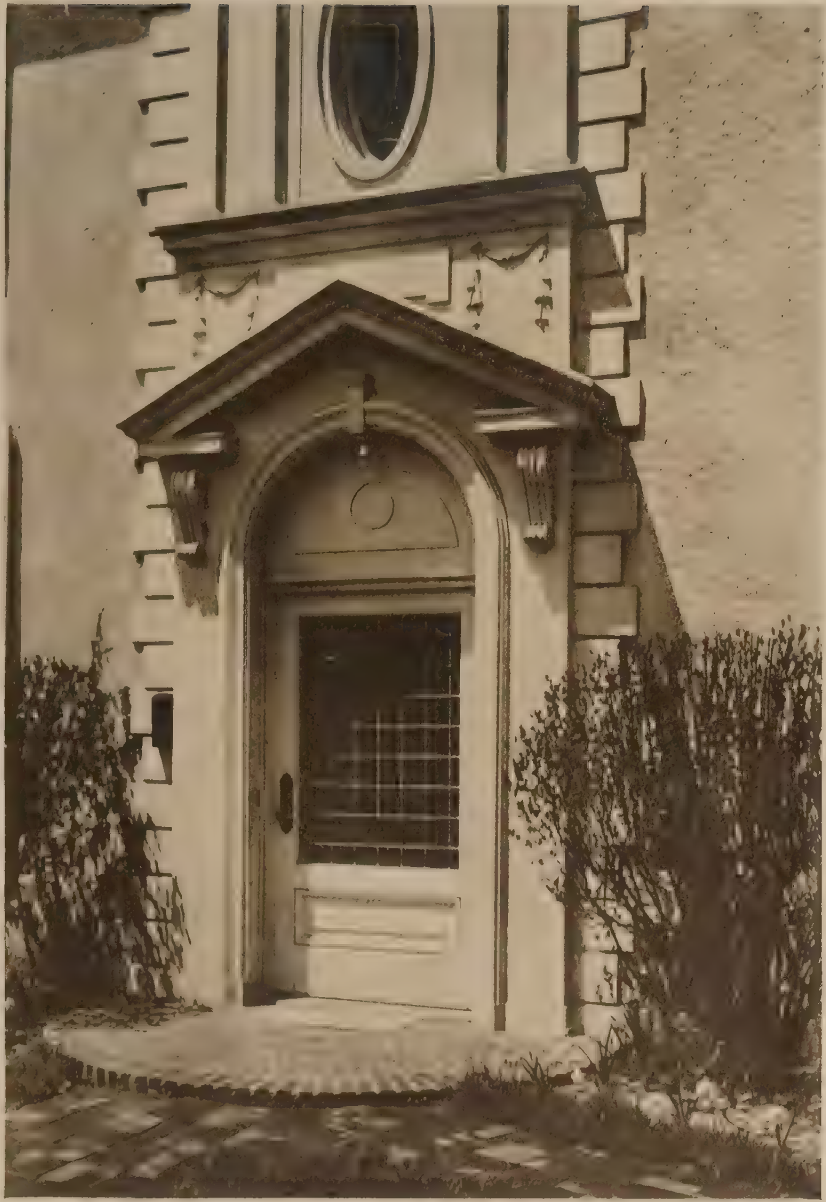






RESIDENCE, MRS. JAMES HARDEN, HARTSDALE, N. Y.

Eugene J. Lang, Architect.



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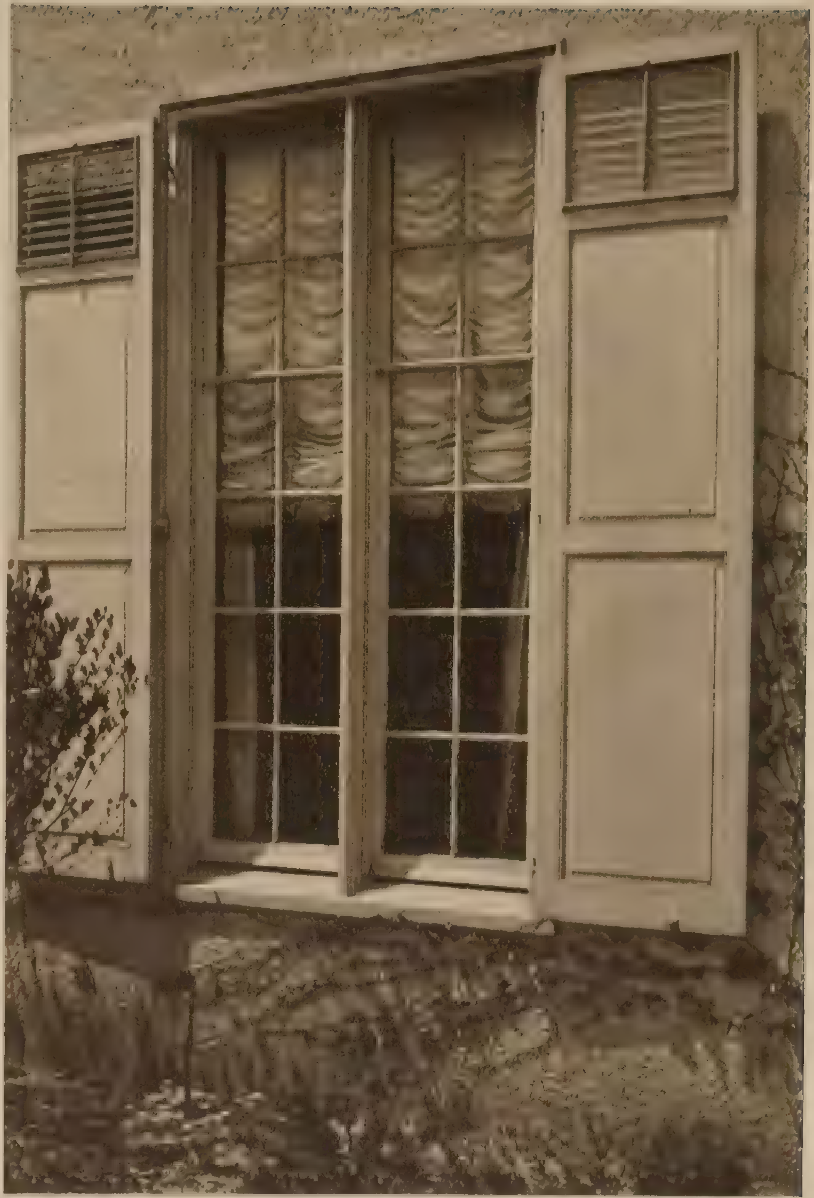
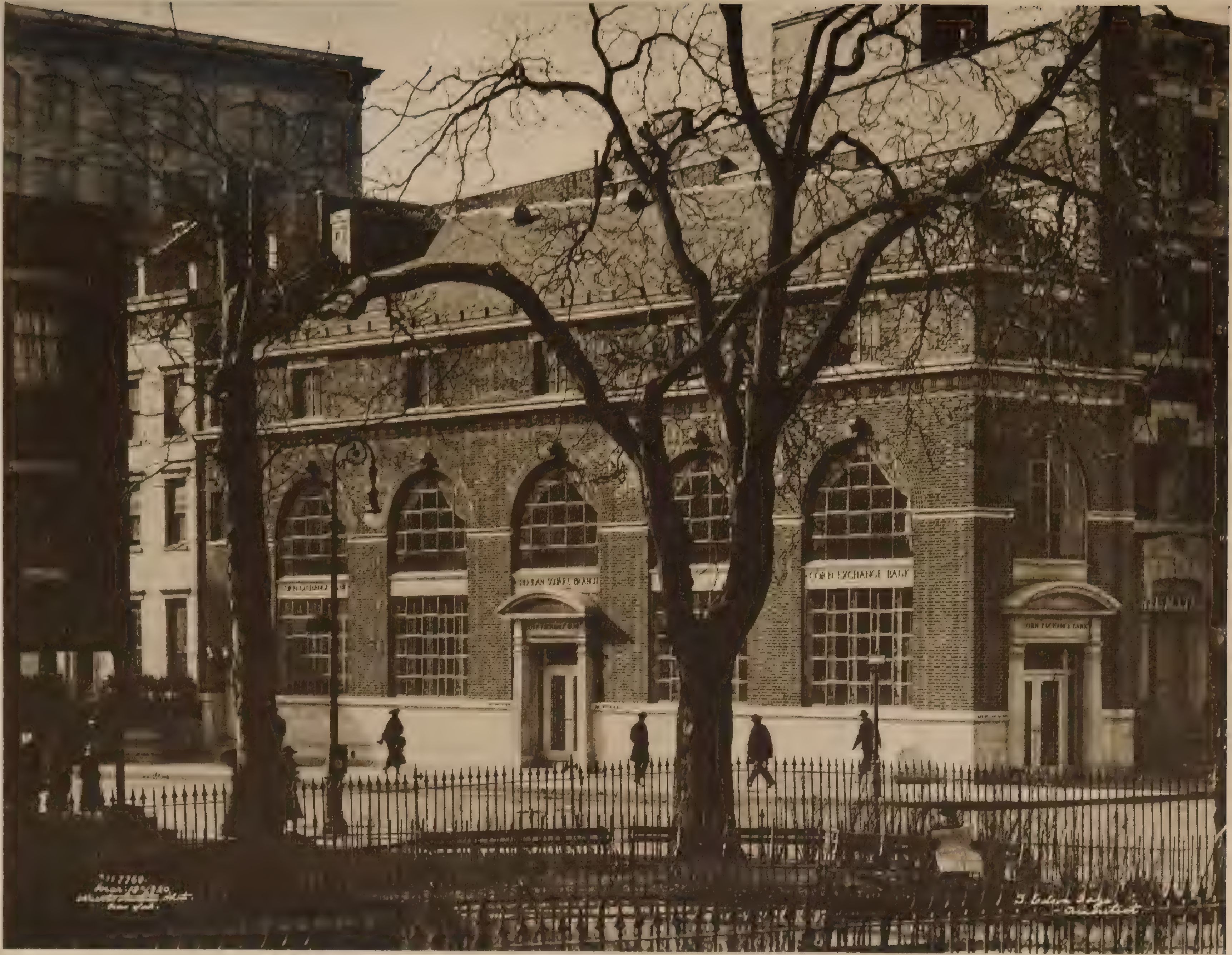


WINDOW DETAIL.

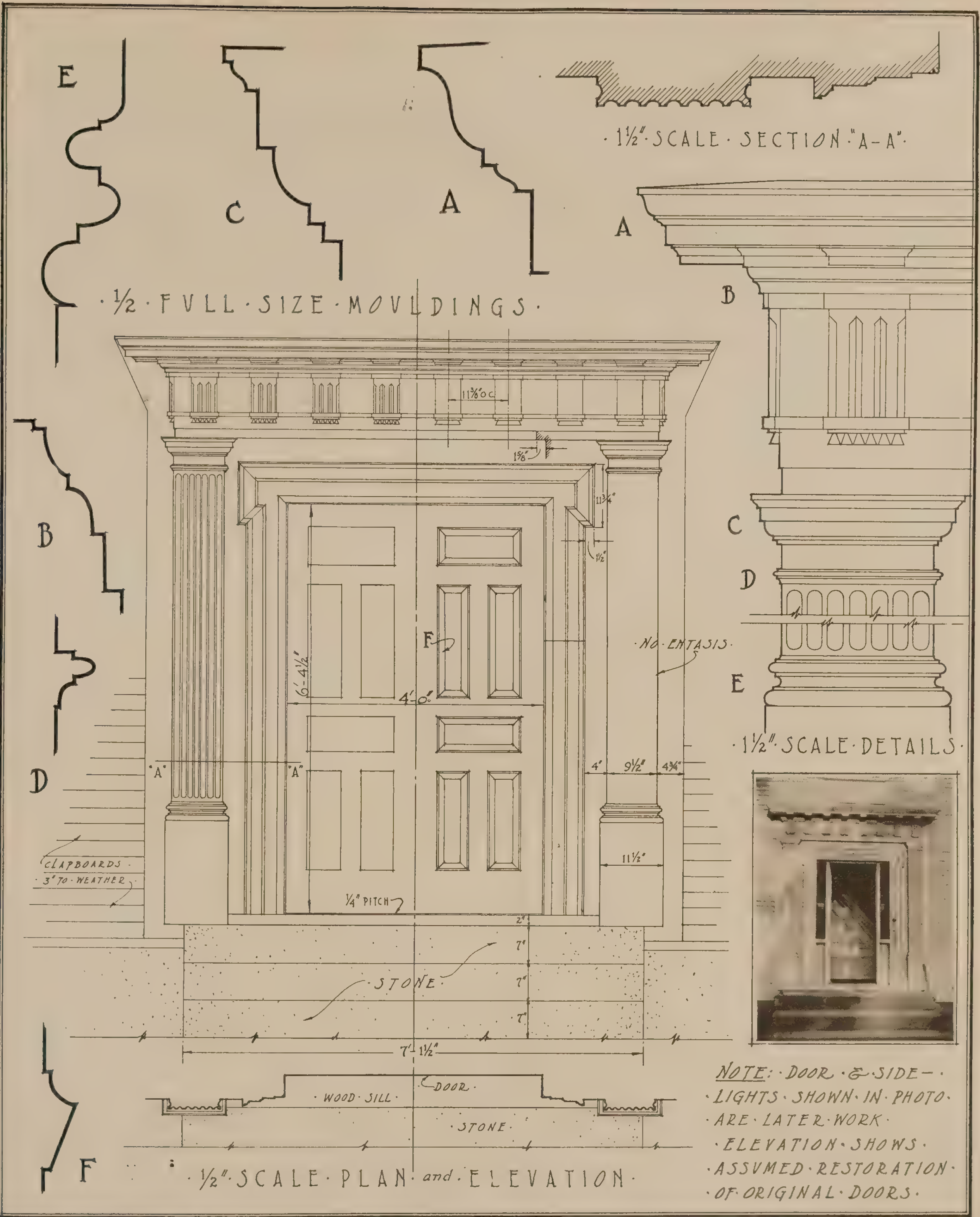
Eugene J. Lang, Architect.

RESIDENCE, MRS. JAMES HARDEN, HARTSDALE, N. Y.



SHERIDAN SQUARE BRANCH, CORN EXCHANGE BANK, NEW YORK.

S. Edson Gage, Architect.



NOTE: DOOR & SIDE-LIGHTS SHOWN IN PHOTO ARE LATER WORK. ELEVATION SHOWS ASSUMED RESTORATION OF ORIGINAL DOORS.

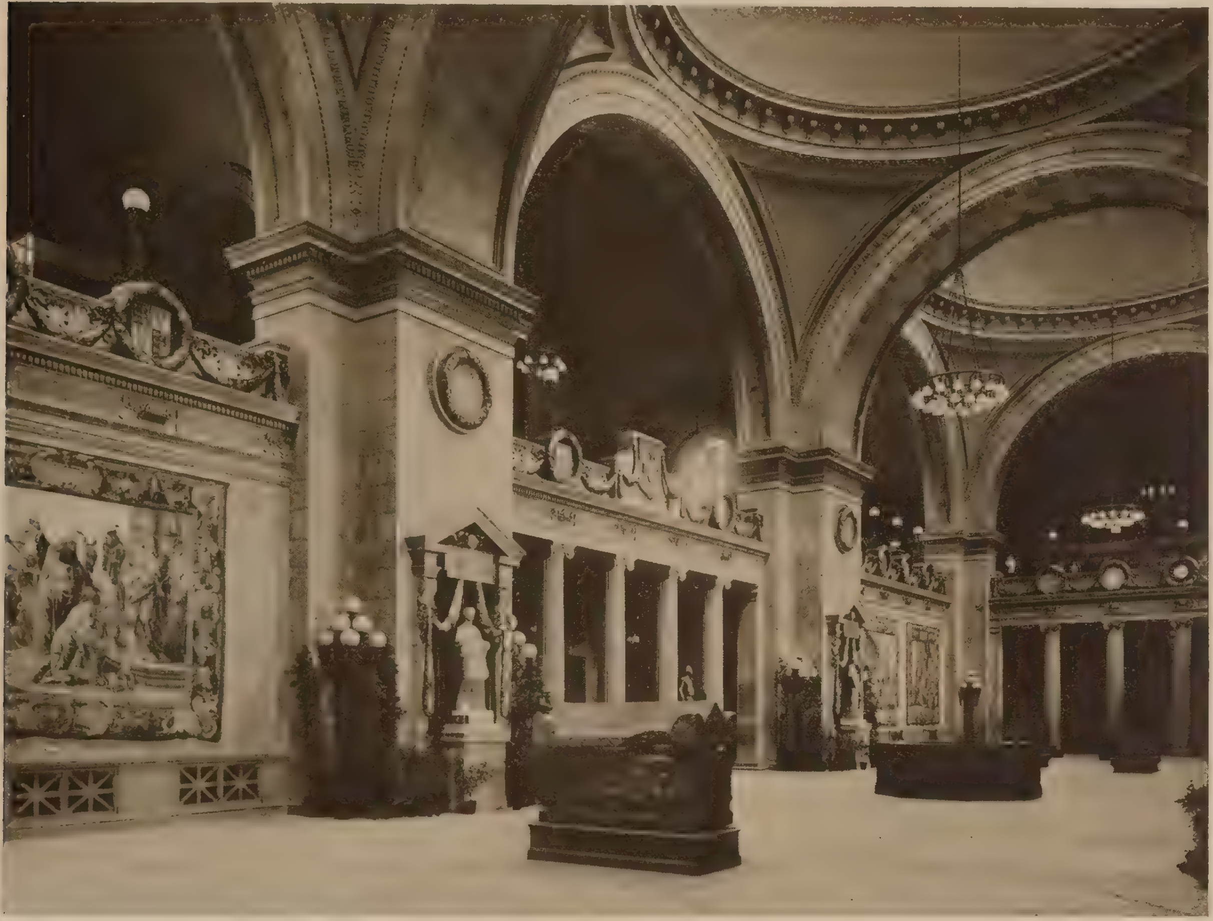
EARLY ARCHITECTURE OF CONNECTICUT

DOORWAY OF THE WELLES–SHIPMAN HOUSE

SOUTH GLASTONBURY CONN

MEASURED BY J. FREDERICK KELLY
DRAWN BY LORENZO HAMILTON

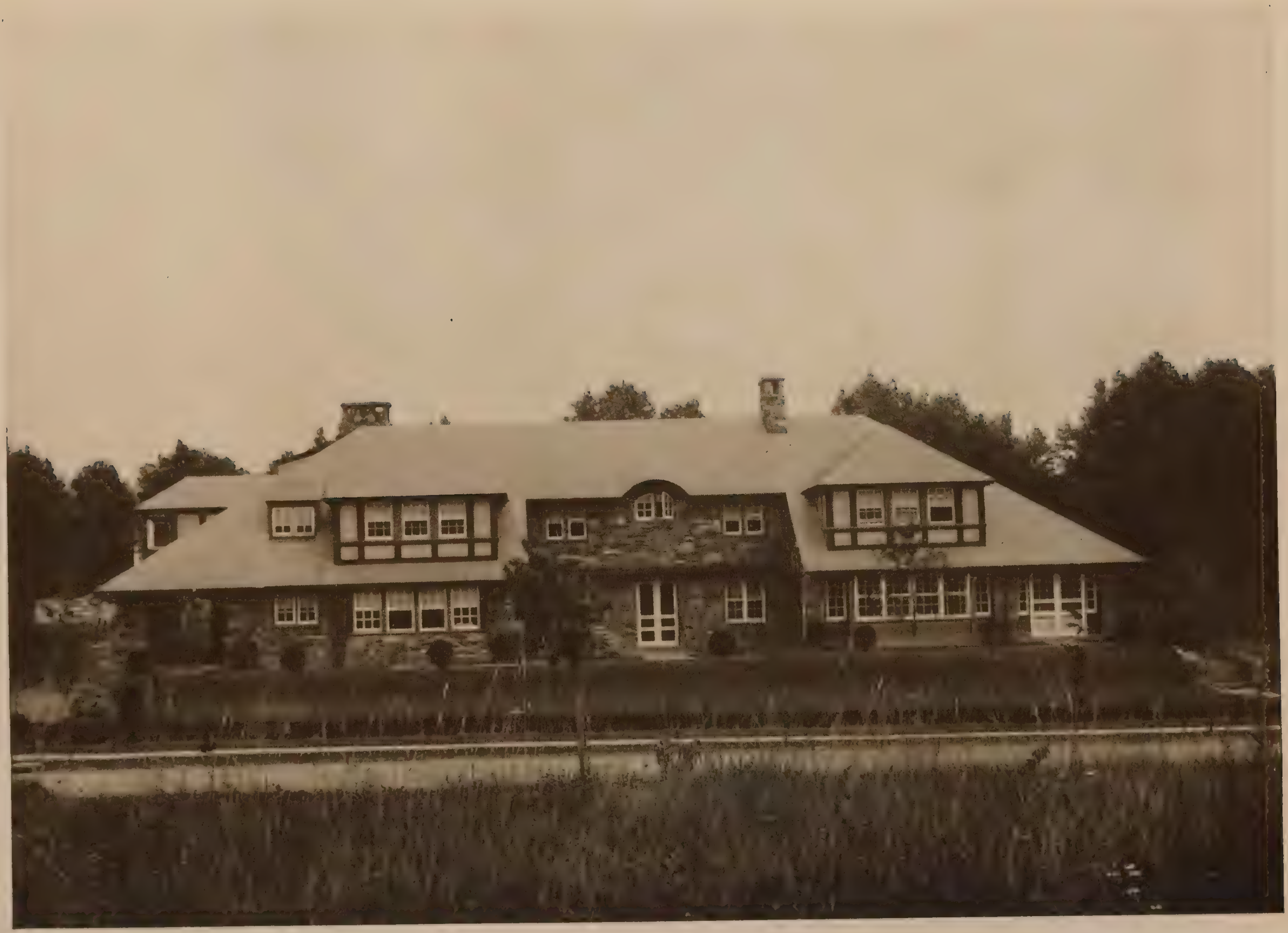
The Fiftieth Anniversary of the Metropolitan Museum of Art



The great entrance-hall on Fifth Avenue has been especially decorated for the celebration from designs executed under the direction of McKim, Mead & White, to whom the Museum acknowledges their indebtedness for their generous contribution. The emblems in the medallions surrounding the hall are those of countries or cities represented in the collections of the Museum. The four heads on the sculptural piers—Painting, Sculpture, Architecture, and Decorative Arts—are the work of Ezra Winter, late of the American Academy in Rome.

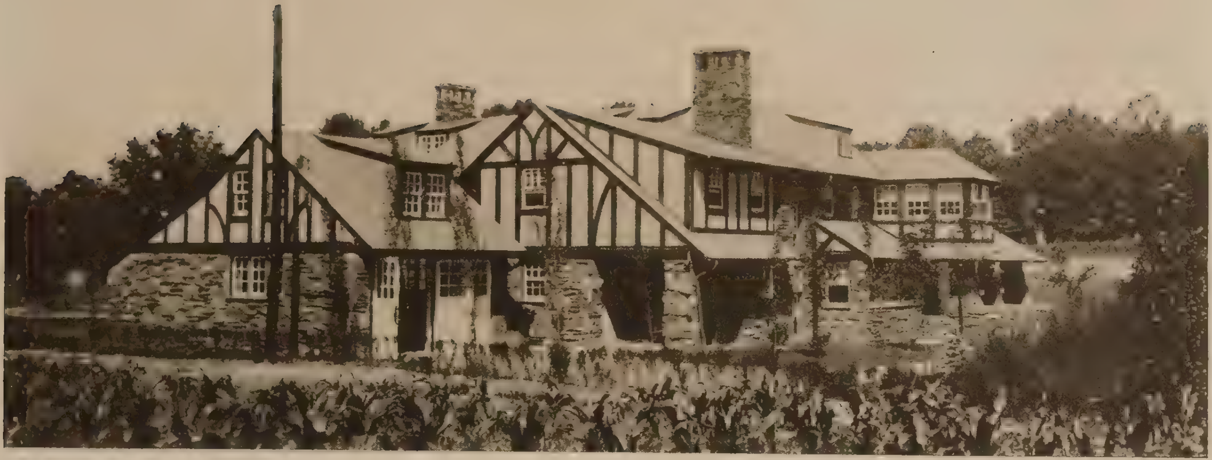
THE celebration of the fiftieth anniversary of the Metropolitan Museum of Art is not only of great interest to New York City and its environing neighbors but as well to the country at large, for the Museum is much more than a local institution. It is national both in its purposes and in its dissemination of useful art knowledge throughout the country. For this celebration of the fiftieth anniversary the Museum has gathered from many sources, including some of the famous private collections, rare pictures and other objects of art that are but little known to the general public.

Among the famous paintings loaned are: "Bacchanal," by Giovanni Bellini, lent by Carl W. Hamilton; "The Smoking Party," by Adrian Brouwer, lent by Michael Friedsam; "Lady Guildford," by Hans Holbein, lent by William K. Vanderbilt; "Portrait of a Musician," by Hans Holbein, and "Portrait of a Man," by Titian, lent by Henry Goldman; "Cardinal Pietro Bembo," by Titian, lent by Charles M. Schwab; "Two Wings of an Altarpiece," by Hans Memling; "Three Saints," by Martin Schöngauer, and "Christ Appearing to His Mother," by Roger van der Weyden, lent by Michael Dreicer; triptych, "Christ and Saints," by Cimabue, lent by Carl W. Hamilton; "Judith with the Head of Holofernes," by Andrea Mantegna, lent by Carl W. Hamilton; "Madonna and Child," by Giovanni Bellini, lent by John N. Willys; "Giuliano de' Medici," by Botticelli, lent by Mr. and Mrs. Otto H. Kahn; "Victor Guye," by Francisco José Goya, lent by J. Horace Harding; "Portrait of a Girl," by Velasquez, lent by John N. Willys; "Portrait of a Man Seated," by Franz Hals, lent by Henry Goldman; four paintings by Rembrandt: "Philemon and Baucis," lent by Mr. and Mrs. Otto H. Kahn; "The Savant," "Saskia," and "Hendrickie Stoffels," lent by Mrs. Henry E. Huntington; "Portrait of Mme. Cézanne," by Paul Cézanne, lent by John Quinn; "Reverie" and "Fisherman," by J. B. C. Corot, lent by George F. Baker; "The Drinkers," by Honoré Daumier, lent by Adolph Lewisohn; "Before the Race," by Edgar Degas, lent by Miss Lizzie P. Bliss; "Ia Orana Maria" and "Women by the River," by Paul Gauguin, lent by Adolph Lewisohn; "Still Life," by Edouard Manet, lent by Mrs. Eugene Meyer, Jr.; "Apple-trees in Blossom," by Camille Pissarro, lent by William Church Osborn; "In the Meadow" and "A Landscape," by Pierre Auguste Renoir, lent by Adolph Lewisohn; "Morning Effect—The Fisherman," by Théodore Rousseau, lent by George F. Baker; "Portrait of the Artist," by Vincent van Gogh, lent by John Quinn.



RESIDENCE, JONATHAN JENKS, MERION, PA.

Frank Seeburger and Charles P. Rabenold, Associated Architects.



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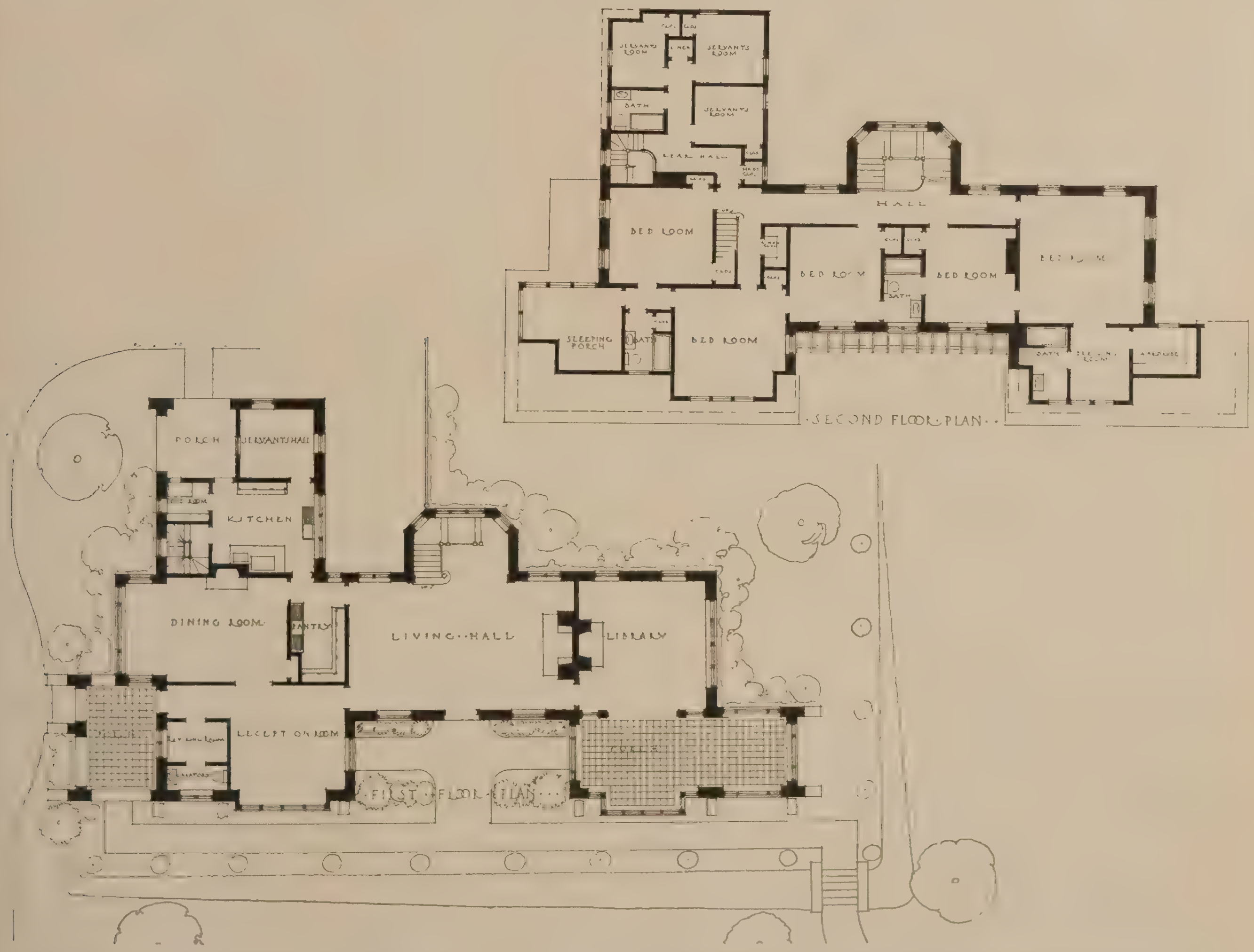

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Notes for Architects on Engineering Moments

Second Article

By DeWitt Clinton Pond, M.A.

IN the last article the general definition of moments was given and the method of determining a moment in the case of a simple cantilever was shown. There was also shown how moments were used to find the maximum tendency toward bending in a simple beam with a concentrated load located directly on its centre, and how the loads at the ends of beams could be determined by the use of the same units.

All these cases were comparatively simple and would only serve as an introduction to the more complicated engineering problems found in the designing of beams, girders, columns, and footings. It will be necessary to expand these conditions in order to furnish the reader with a more comprehensive foundation for engineering calculations.

In Figure VII, article I, the method of using moments in order to obtain the loads at the ends of beams was shown graphically. The same kind of problem but with more complicated loading is shown in the diagram in Figure VIII. Here the span of the beam is represented as being 24 feet and 6 inches long and the loads as 125, 260, 85, and 42 pounds respectively located 3 feet, 5 feet, 13 feet, and 18 feet from the left-hand support—R_1. The first step in designing a beam that will withstand such loading is the determination of the loads at the reactions, at R_1 and R_2.

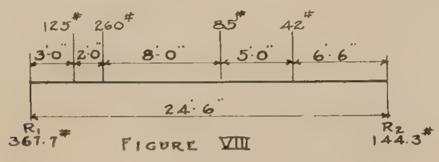


FIGURE VIII

As has been pointed out in the last article, the method by which the load at one end is found is to take moments around *the other end*. Usually the right reaction—R_2—is the one first determined, and in this case the centre of moments must be considered as being at the left support or at R_1. The moments caused by the four loads on the beam will be found as shown below.

125 × 3 = 375 foot-pounds
260 × 5 = 1,300 "
85 × 13 = 1,105 "
42 × 18 = 756 "
Totals 512 3,536 "

The total moment around R_1 is 3,536 foot-pounds, and this must be counteracted by the moment caused by R_2. The lever-arm from the left reaction to the right reaction is 24 feet and 6 inches. This lever-arm, multiplied by the right reaction, should give the total moment shown above, or $R_2 \times 24.5 = 3{,}536$. In order to determine the value of R_2 it is only necessary to divide 3,536 by 24.5. The answer will be 144.3 pounds.

The value of R_1 can be found by simply subtracting this figure from the total load, or from 512 pounds. 512 − 144.3 = 367.7 pounds. It would be well for the beginner to check this result by taking moments around R_2 in order to determine R_1. The method of doing this will be given below.

42 × 6.5 = 273 foot-pounds
85 × 11.5 = 977.5 "
260 × 19.5 = 5,070 "
125 × 21.5 = 2,687.5 "
Totals 512 9,008.0 "

9,008 ÷ 24.5 = 367.7 pounds.

This result checks with the one given above. It is usually a good practice to check results in this manner.

It might be well in passing to note that if foot-pounds are divided by feet the answer is found to be in pounds. On the other hand if foot-pounds are divided by pounds the answer will be expressed in feet.

The next step in the design of a beam is to determine the point at which it will have the greatest tendency to fail by bending. In the case of the cantilever it was obvious that the point at which the beam would fail was at the point at which the beam projected out into space. In the case of the simple beam, where the load was directly in the centre, the point of failure would be directly under the load. In the example under consideration it would be difficult to tell without investigation the exact point at which the greatest tendency toward failure will be. In order to thoroughly investigate this problem use is made of the shear diagram.

Until now no mention has been made of "shear." There are two ways in which a beam may fail. The first is by bending, which is the most common method by which failure occurs. When a beam fails in this manner the upper fibres of it are crushed together and the lower fibres are pulled apart. The second way in which it could fail is by shear. When a hole is punched in a steel plate the steel is simply sheared out. Shear is that method of failure in which particles slide by each other. The most common case in which a beam will fail by shearing is in the condition where the beam is short and the load is heavy. Figure V, article I, shows a condition where the beam would fail by shear rather than by bending.

Where a heavy load comes on a short beam the load acts as the punch and the supports as the die and the beam is sheared off at the supports in much the same manner as a piece of steel is sheared off by machinery in a steel-mill. Shearing depends upon the dead weight upon the beam and does not depend upon the distance such a weight acts away from a support. The greatest tendency toward shearing is found at the supports, and is equal to the load at the reaction. The value of shear is measured in units of weight. In the case of the beam shown in Figure VIII the greatest shear is found at the left reaction and is equal to 367.7 pounds.

It is sometimes difficult for the student of engineering to grasp what is implied by the word shear. If, in the case given above, he should look upon the force exerted in an upward direction by the reaction as the force imposed by one blade of a pair of shears, and if he should look upon the force caused by the loading on the beam as imposed by the other blade he will obtain a fairly graphic idea of this method of failure. The upward shearing force is equal to the downward force and both are equal to the reaction.

This shear will exist between the support and the first load. Between the first and second loads a smaller shear will exist as the shear will be diminished by the exact amount of the first load. In other words, the value of the shearing force between the left reaction and the first load is 367.7 pounds, and between the first and second loads is 242.7 pounds. Between the second and third loads the shear becomes a *negative* shear, because the second load of 260 pounds is greater than the shear at the left of it. At the left of this load the shear is 242.7 pounds; at the right of it the shear becomes *minus* 17.3 pounds. In the parlance of the engineer "the shear changes sign." The negative shear increases as the other downward loads are encountered. After the third load is passed the shear becomes *minus* 102.3 and after the fourth it becomes *minus* 144.3 pounds. This negative or downward shear continues until the right reaction, or R_2, is reached, when this upward load will exactly counteract the downward shear and the result will be zero.

This condition is shown graphically in the "shear diagram" in Figure IX. This is a typical diagram for the condition where all the loads on the beam are concentrated at points along it. It resembles a crude flight of steps in which the "treads" are the distances between loads, and the "risers" are the loads themselves. A diagram such as this may be laid out at any scale with different units representing length and weight.

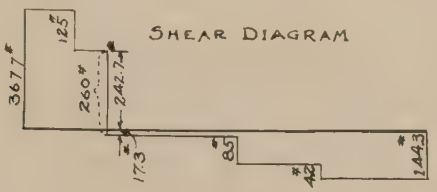


FIGURE IX

The important thing about a shear diagram is that from it one can tell at what point the beam is liable to fail by bending. At that point where the shear changes sign or becomes zero is the point where the greatest tendency toward bending is found. One must delve into the mysteries of calculus to prove this as far as formulas are concerned, but the reader may prove it practically by actually investigating the case of the beam with unequal concentrated loads, shown in Figure VIII. It might be well to investigate the tendency toward bending at all points where loads are concentrated.

The first load is concentrated at a point 3 feet from the left support. The tendency toward bending at this point will be caused by the left reaction, as this is the only load acting to the left of the one under consideration. The reaction is 367.7 pounds, the distance from the present centre of moments is 3 feet, and the moment is 1,103.1 foot-pounds.

The second load is located 5 feet away from the left support and there is one load between it and the left reaction. The method of determining the bending moment at this point is to find the upward or positive moment due to the upward reaction and to subtract from it the downward or negative moment due to the downward load. The upward moment is found by multiplying 367.7 by 5 feet. The result, 1,838.5 foot-pounds, is the positive moment. The downward moment is found by multiplying 125 pounds by 2 feet, and the negative moment is determined as 250 foot-pounds. By subtracting the negative from the positive the actual moment of 1,588.5 foot-pounds is found.

The third load is 13 feet from the left reaction and the positive moment is 367.7 × 13 = 4,780.1 foot-pounds. There are two negative moments, as there are two downward loads at the left of load number three.

125 × 10 = 1,250 foot-pounds.
260 × 8 = 2,080 "
3,330 "
4,780.1 − 3,330 = 1,450.1 foot-pounds

The fourth load is 18 feet from the left reaction. The moment at this point can be found by the same method as has been given.

367.7 × 18 = 6,618.6 (positive moment)
125 × 15 = 1,875
260 × 13 = 3,380
85 × 5 = 425
5,680 (negative moment)
6,618.6 − 5,680 = 938.6 foot-pounds.

In this manner are found the tendencies toward bending at four different points on the beam. It will be noticed that in taking the points at which the moments were determined the process was to read from left to right, and that the negative moments were always caused by loads at the left of the point under discussion. Exactly the opposite process could have been used and the points read from right to left and the negative moments would then be caused by the loads at the right of the point. As a check on the last result and in order that the last statement can be shown to be true, the moment at the fourth load will be determined by finding the moment caused by the right reaction around this load. The right reaction—R_2—exerts an upward force of 144.3 pounds, and it acts at a distance of 6.5 feet from load number four. The moment then will be 144.3 × 6.5 = 938 foot-pounds. It will be noticed that this result does not check exactly with the one given above, but this is due to the fact that the two reactions are determined only to the first place beyond the decimal point, which is accurate enough for all practical purposes, but does not give the exact amount when moments are determined at the right or left of a certain point.

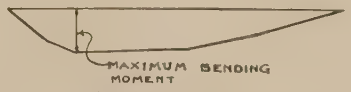


FIGURE X

A bending moment diagram is shown in Figure X. The figures are the same as those already determined. The maximum bending moment is discovered under the second load, and this is in accordance with the statement that the maximum moment will be found at the point where the shear changes sign. An investigation of the shear and bending moment diagrams will show this to be the case.

This discussion has been largely theoretical, and may not seem to have much value. Actually the shear diagram is a very practical time-saver. It has been shown that by means of this diagram the point at which the maximum tendency toward failure by bending is found. This is important as beams and girders are designed to withstand the maximum bending moment, and once this is found, it is only necessary to find the size of the beam which will answer this purpose.

As an actual example of this the maximum bending moment found above was 1,588.5 foot-pounds, or 19,062 inch-pounds. The formula given in the last article for the design of a wood beam is $M = S \times \frac{1}{6}bd^2$. We will assume that S—the strength of wood—is 1,200 pounds per square inch, that b—the breadth of the beam—is 2 inches, and that it will only be necessary to find the value of the depth d.

The formula becomes, when all the values are substituted, $19{,}062 = 1{,}200 \times \frac{1}{6} \times 2 \times d^2$, or, $19{,}062 = 400d^2$. It can be found from this that d^2 will equal 47.7 inches and that d becomes 6.9 inches, and that the beam that will withstand the loading given in the problem will have to be a 2-inch by 8-inch beam.

So far all problems have dealt with concentrated loads, but as a rule, the most common loading on beams is known as uniform loading. By this is meant that most loads on beams are spread over a part of, or over their entire lengths. The first example of this kind of a problem is shown in Figure XI which is a diagram representing a simple beam with a uniform load extending over the entire span. For a condition such as this the formula $M = \frac{1}{8}Wl$ can be used and the beam designed without much effort, but as there are many conditions where a beam is loaded with both concentrated and uniform loads it is important that the reader understand all the principles involved in the derivation of this formula.

In Figure XI is shown the shear diagram. It will be seen that this diagram differs from the one shown in Figure IX as the shear changes not in a series of steps, but as an inclined straight line which passes through zero at the centre. This is the point at which the shear changes sign, and where the greatest tendency toward bending will be found. It is obvious that the beam will bend more in the centre than at any other place.

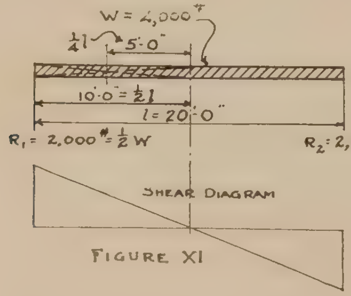


FIGURE XI

It will be necessary to determine the bending moment at this point, and an actual condition of loading will be assumed. The span will be considered as 20 feet, and the load as 200 pounds per foot. The total load on the beam will be 4,000 pounds, and the load at each end will be one-half of this or 2,000 pounds. The upward moment around the centre caused by the reaction will be $2{,}000 \times 10 = 20{,}000$ foot-pounds. It is sometimes difficult to understand the next step. This step consists of determining the downward or negative moment which is caused by part of the uniform load at the left of the centre point. The half of the uniform load that is at the left of the centre point will cause a downward or negative moment around this point. The amount of this load is 2,000 pounds and the lever-arm will be the distance between the centre point and the centre of gravity of that part of the uniform load that is causing the moment. In other words it will be the distance between the centre and a point 5 feet to the left of it. The moment will be $2{,}000 \times 5 = 10{,}000$ foot-pounds. This should be subtracted from the positive moment and the result—10,000 foot-pounds will be the total moment at this point and the maximum for the beam.

Suppose that algebraic letters were substituted in place of actual loads and distances then the load will be designated as W, which will stand for the total load of 4,000 pounds, and the span will be denoted as l. Then the loads at the supports—the reactions—will both equal $\frac{1}{2}W$, and the distance from the centre to the reaction will be $\frac{1}{2}l$. The positive moment will be $\frac{1}{2}W \times \frac{1}{2}l = \frac{1}{4}Wl$. The negative moment will be caused by one-half of the load, which extends over the beam to the left of the centre, and the lever-arm will have a length equal to *one-quarter* of the span. This length was equal to 5 feet in the example given above. With the downward load equal to $\frac{1}{2}W$, and the lever arm equal to $\frac{1}{4}l$ the negative moment will equal $\frac{1}{8}Wl$. Subtracting the negative from the positive moment the result will be $\frac{1}{4}Wl - \frac{1}{8}Wl = \frac{1}{8}Wl$.

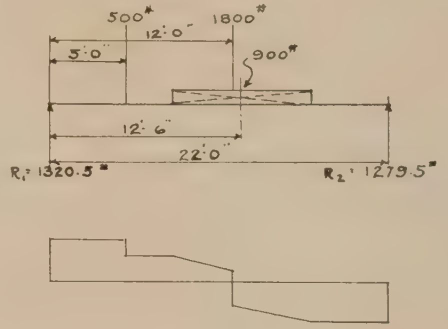


FIGURE XII

The formula $M = \frac{1}{8}Wl$ is one of the most useful in all engineering work. It is used to develop all tables giving safe loads uniformly distributed on beams as well as deflection tables, and in all calculations involving uniform loads. On the other hand the reader must not make its use too general. It will not apply to a condition where concentrated loads are encountered or where the uniform loads do not extend over the entire spans.

If there is need of proof of this formula, other than that already given, it may be well to substitute in the formula the load and span in the previous problem. In this example the total uniform load was 4,000 pounds, and the span 20 feet. Now the formula is $M = \frac{1}{8}Wl$. Substituting in it the result is $M = \frac{1}{8} \times 4{,}000 \times 20 = 10{,}000$ foot-pounds, which is the result obtained without the use of the formula.

There is only one other condition to be investigated. This is the case where there is a combination of uniform and concentrated loads. Diagrammatically this is shown in Figure XII. There are two concentrated loads on the beam; one is 500 pounds, located 5 feet from the left support, the other is 1,200 pounds, located 12 feet from the left support. The uniform load is 900 pounds and extends from a point 8 feet from R_1 to a point 5 feet to the left of R_2. The *method* of finding the reactions does not differ from that given above, but there is a difference in procedure when the uniform load is encountered. This load is regarded as a concentrated load with the entire 900 pounds concentrated at the centre of gravity, which in this case is one-half of a foot to the right of the 1,200 pound load and 12 feet and 6 inches from the left support.

500 × 55 = 2,500 foot-pounds
1,200 × 12 = 14,400 "
900 × $12\frac{1}{2}$ = 11,250 "
2,600 28,150 "
28,150 ÷ 22 = 1,279.5 pounds = R_2
2,600 − 1,279.5 = 1,320.5 pounds = R_1

The shear diagram shows that the shear changes sign under the 1,200 pound load, and this is therefore the point of no shear or maximum bending moment. The bending moment at this point is obtained in the usual manner.

Positive moment,
1,320.5 × 12 = 15,846 foot-pounds
Negative moments,
500 × 7 = 3,500 foot-pounds
400 × 2 = 800 "
4,300 "
15,846 − 4,300 = 11,546 foot-pounds

No matter how complicated a problem in the design of beams or girders may appear it cannot involve any considerations which have not been investigated in these two articles. It can be seen that all problems involve the use of moments. This will be true of nearly all problems in the design of beams, girders, slabs, footings, or foundations. The importance, therefore, of the knowledge of the use of moments should be appreciated.

Practice is as important in the profession of engineering as in the game of golf. No one would expect to be able to play golf because he has read a book about the game. In the same manner unless the reader practises the use of moments he will never be expert in the design of structures. It is therefore suggested that he invent problems for his own practice and check each result. One of the encouraging things about the study of engineering is that all results can be checked.

A Fine Memorial

The Burnham Library of Architecture at the Art Institute, Chicago

WITH the opening of the Burnham Library of Architecture, says the *Bulletin of the Art Institute of Chicago*, one of Daniel Hudson Burnham's cherished projects for the civic beautification of Chicago approaches realization. At his death in 1912 he bequeathed a fund of fifty thousand dollars to be administered by the trustees of the Art Institute for an architectural library. Before the end of that year the president of the board of trustees had appointed a committee of five architects, who have outlined, and are now consummating, a policy of obvious soundness—their declared aim being "to cover the field of architecture and landscape architecture, in books and photographs, as generally as funds will allow." An agreement with the libraries of the city is leaving the field of architecture clear for the Burnham Library. First were purchased the books on architecture in the Ryerson Library, later the architectural magazines in the John Crerar Library—all of which were temporarily housed in the Ryerson Library. In accordance with a well-worked-out plan the most necessary additions have been secured, even when the works sought have been rare and costly. The collection at present numbers more than 2,500 volumes. Howard Van Doren Shaw, Peirce Anderson, Hubert Burnham, Edward H. Bennett, and Walter F. Shattuck (who has been succeeded by Edmund S. Campbell, head of the Department of Architecture in the school) formed the original committee. Mr. Shaw, its chairman from the beginning, designed the new library.

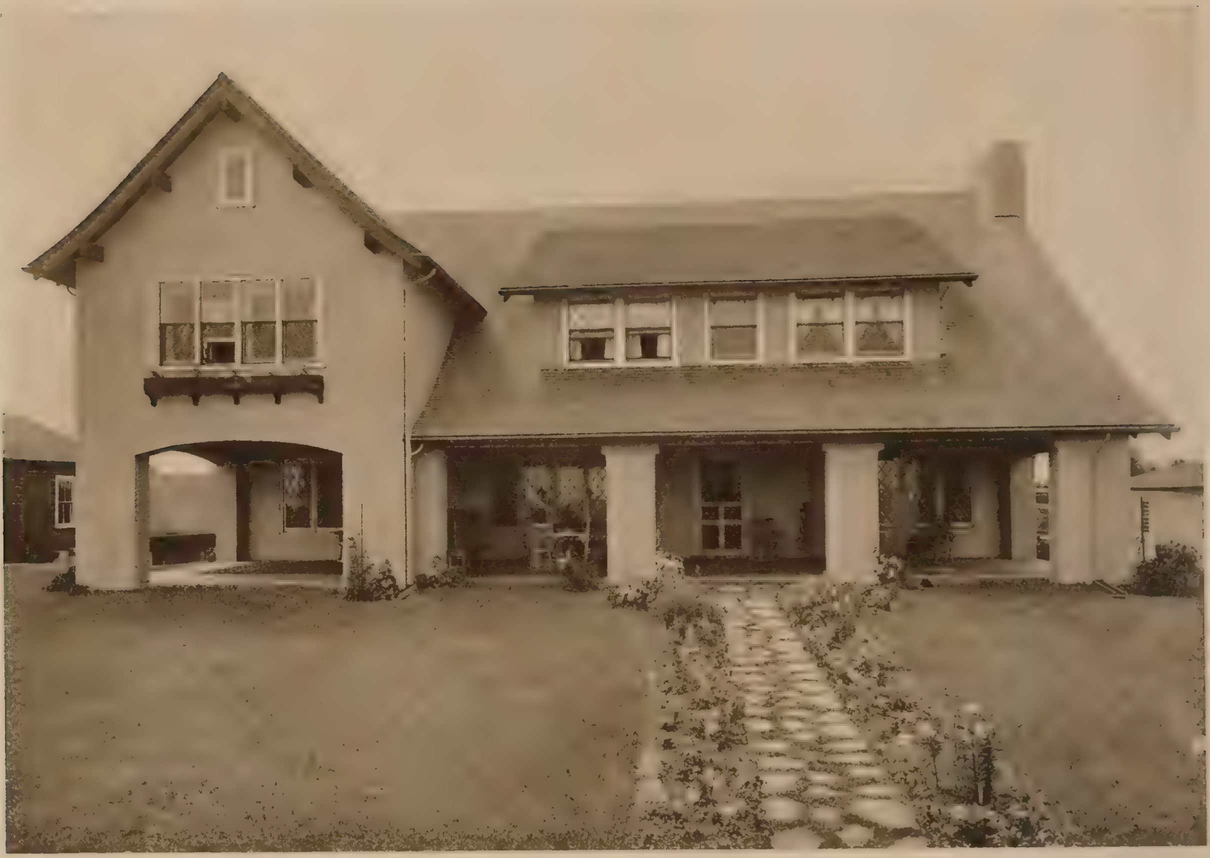
A striking contrast with the character of the Ryerson Library is presented in this new room opening from it. The Renaissance feeling is replaced by the mediæval, the circular form of chamber by that of a long barrel-vaulted hall. The doorway is in the middle of the north wall. High-leaded lights in that wall permit a beautiful play of light and shadow on the vaulted ceiling. The lamps, concealed in inverted opaque bowls suspended from the ceiling, cause a diffused glow in the room. The decorative value of the long shelves of books, with their bright colors, in this room of gray oak and rough plaster, the high windows, the furniture with its slightly monastic character, the hooded reading-lamps, the high reading-desks placed at intervals near the bookcases, the vaulted ceiling, and the sparse use of ornament, give the room a compelling character. Zorn's fine portrait of Daniel H. Burnham, lent by Mrs. Burnham, faces the entrance.

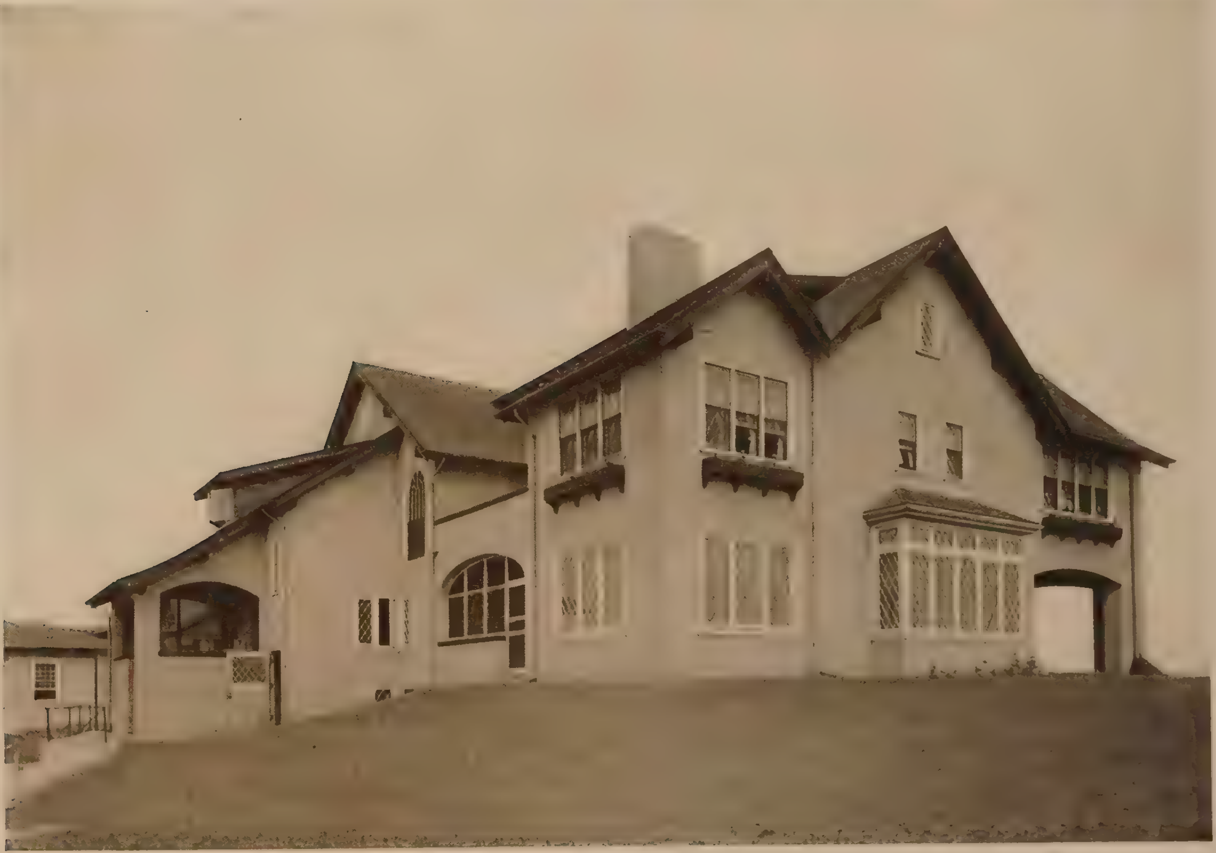
Already the library is a daily necessity to the students of the Chicago School of Architecture, who work at the Art Institute. What it may do for architecture through these students is more than a pleasant conjecture. Its wider opportunity is plain. In this city of departmental libraries here is a well-laid foundation for the architectural collection of the city.

A comprehensive library on civic art is needed for the new Chicago. The home-builders, landscape gardeners, and all the younger architects, may find here the plates and periodicals which are beyond their means of owning. And with the growth of the collection of books and magazines will come the gradual realization of the policy implied in the bequest of Daniel H. Burnham.

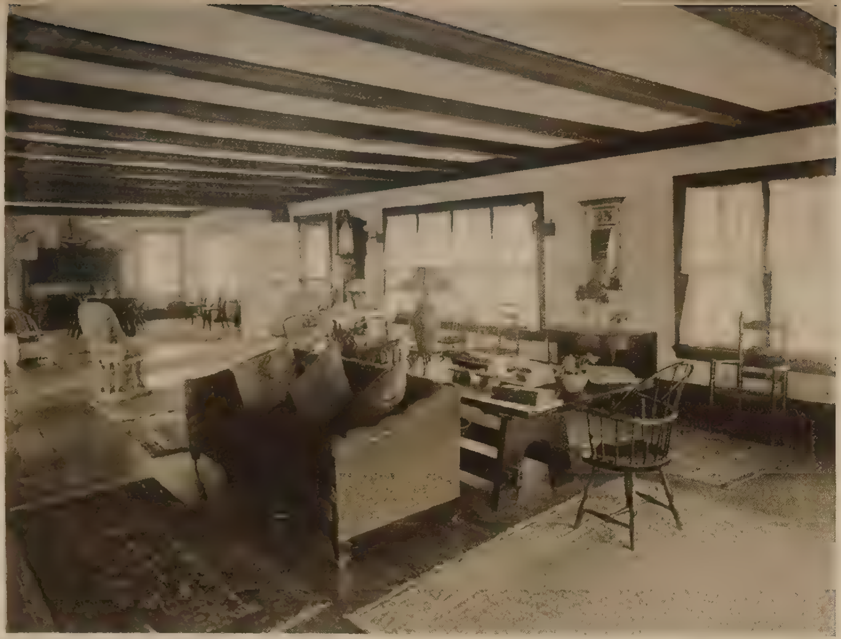
A Roosevelt Tree Road

AT a memorial-tree planting in memory of Theodore Roosevelt and Quentin Roosevelt, Charles Lathrop Pack, president of the American Forestry Association, said in a recent address at Flushing: "A Roosevelt Road of Remembrance, planted with memorial trees from ocean to ocean, would be the greatest of all memorials that could be erected in honor of the former president." Two white oaks that have been registered on the association's honor roll were dedicated in honor of the president and his son.

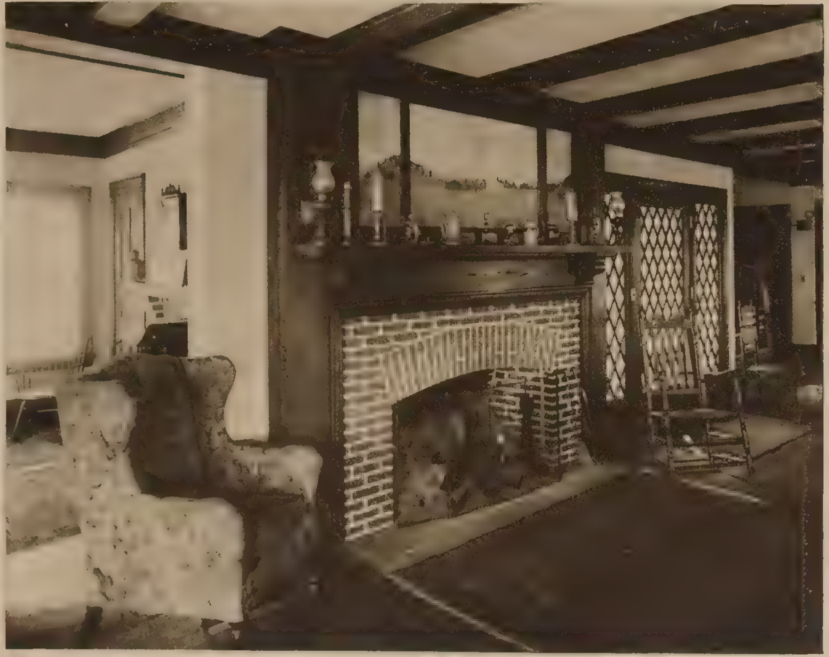




RESIDENCE, H. P. BENSON, MARBLEHEAD NECK, MASS. John P. Benson, Architect.



LIVING-ROOM AND DINING-ROOM IN REAR.



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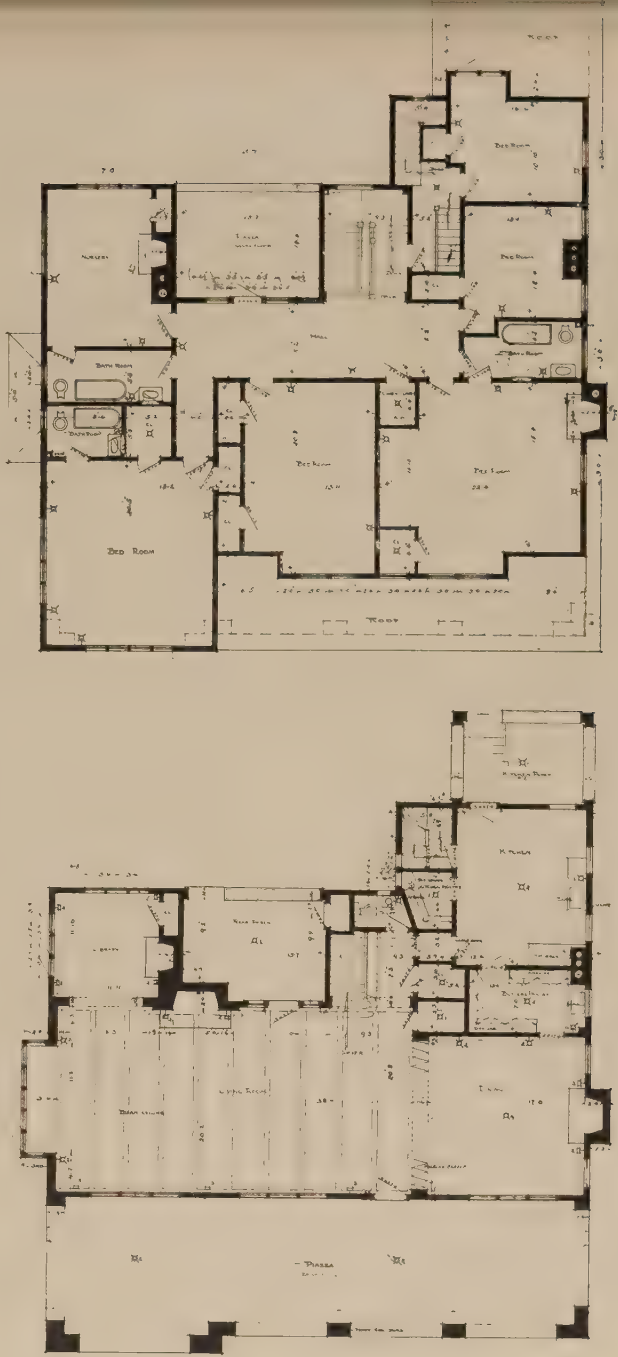

PLANS.

John P. Benson, Architect

RESIDENCE, H. P. BENSON, MARBLEHEAD NECK, MASS.

The Place of the Institute

IN his address at the Fifty-third Annual Convention of the Institute in Washington, President Kimball said: "I know of no organization whose possibilities are greater—possibilities for service to society, I mean."

If these possibilities are yet to be realized it is not through lack of high ideals in the past nor want of sincere endeavor. Perhaps no factor has more determined and limited the achievements of the Institute in its wider usefulness than the fact that it represents but 10 per cent of the architects of the country. It has been in the nature of a close corporation, and in these expanding and progressive days there is need for the closest co-operation and unity of purpose of the entire profession. We quote the following significant paragraphs from President Kimball's address:

Little Greek Theatre, Corcoran Art Gallery, Washington, D. C. Waddy B Wood, Architect.

"For the sake of argument, let us keep in mind the fact that while the American Institute of Architects is still far from being numerically representative of the profession, it has from its birth furnished to the profession the ideals and examples after which the architectural practice of this country has been patterned, and has always been the court of last resort before whose bar all its serious and most important questions have been decided. Wherefore, in assuming for the Institute the credit of such leadership, we are debarred from disclaiming our share of the blame, where blame exists, for conditions that are not consistent with what should be present-day architectural heritage. During the sixty-three years of the life of the American Institute, profound changes have taken place in almost everything but the Institute itself; possibly out of love for its traditions, possibly largely the result of habit, those responsible for the A. I. A. have not seemed to take into account that its work has grown out of all proportion to its membership and machinery. The official instrument to adequately represent and make the most of a great public servant, such as is our profession, should count as members approximately one-half of those who legitimately practise that profession, which means we owe it to our pretenses to promptly secure a membership of at least 3,000, which in turn means better than doubling our present list. To do this, and do it fairly, changes are essential, membership must be made both more attractive and more easily attained. I place representation, adequate representation, as one of possibly three essential fundamentals in which the American Institute is not quite filling the bill.

"A second important item, in which we must assume for the Institute full responsibility, is the example set to all architects as well as to all professions, of valuing professional service upon a percentage basis. To the baneful effects of this one *faux pas* I ascribe most of our really serious troubles. Certainly failure to hold, in a higher degree, the confidence of the public and of the client is traceable directly to this fallacious and mischievous source of suspicion which we have erected into a barrier between ourselves and our clients and society. Until architects as a class realize this and better understand the nature and extent of the harm done, I feel perfectly sure they will never enjoy that position of trust in the community to which their qualifications should entitle them, nor will they achieve that degree of usefulness which the public has a right to expect of them; and until the American Institute has set the example of changing this, to me, perfectly indefensible system to one which by its nature removes the cause of suspicion, I feel the Institute will continue to occupy a position of not quite 'filling the bill.' This item of a right basis for professional charges is, to my mind, one of those three fundamentals in which we are not quite measuring up, and for which I earnestly bespeak a cure."

New Officers of The American Institute of Architects for 1920–1921

President	Henry H. Kendall, Boston
First Vice-President	Charles A. Favrot, New Orleans
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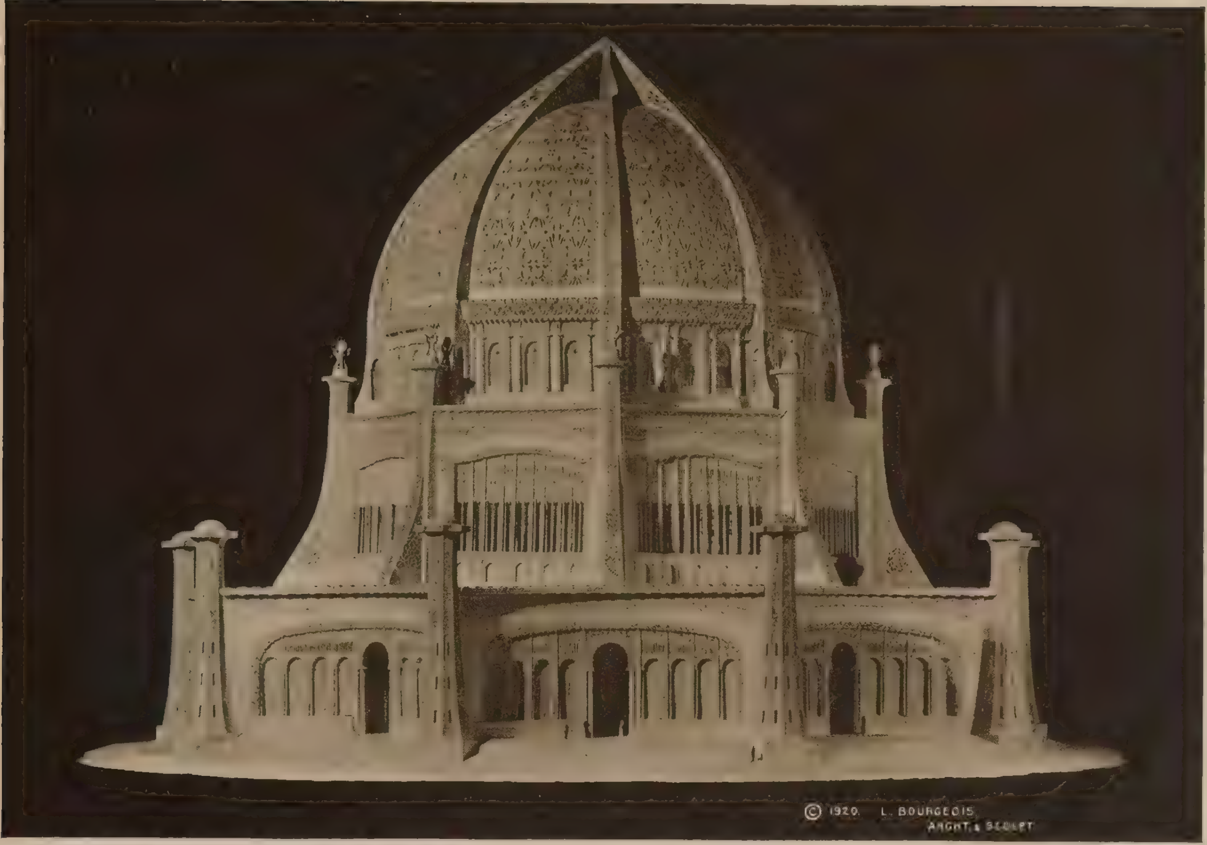
Edwin H. Hewitt, William B. Ittner, Ernest J. Russell

For Three Years—1920–1923
Charles H. Alden, N. Max Dunning, Abram Garfield

A New Idea in Architecture



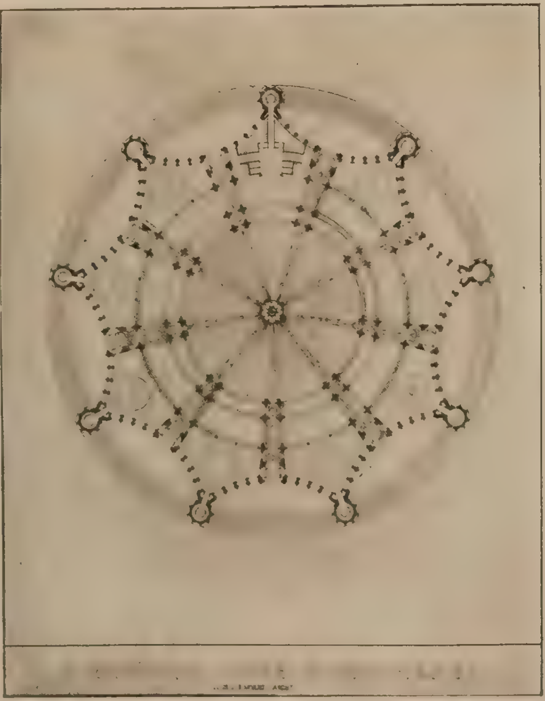
Model for the Bahai Temple of Peace.

ON the shore of Lake Michigan, north of Chicago, the Bahai movement is soon to begin the erection of a great Temple of Peace.

The doors of the Bahai Temple of Peace will never close, day or night, and all may worship there regardless of creed. The Temple will cost about $1,500,000. It will be 225 feet in diameter and 180 feet high, its outer walls covered with cream-colored terra-cotta.

The model submitted by Louis Bourgeois was selected by a committee of forty-nine. This committee approved the design, but, because the structure differed from any other building that had ever been erected, they felt that they needed expert guidance from an architect who could tell them whether it was practical, before making the formal acceptance.

Mr. H. Van Buren Magonigle, president of the Architectural League, was consulted, and without knowledge of the committee's choice he studied all the models submitted and quickly selected that of Mr. Bourgeois. His comment was: "It is the first new idea in architecture since the thirteenth century; I want to see it erected."

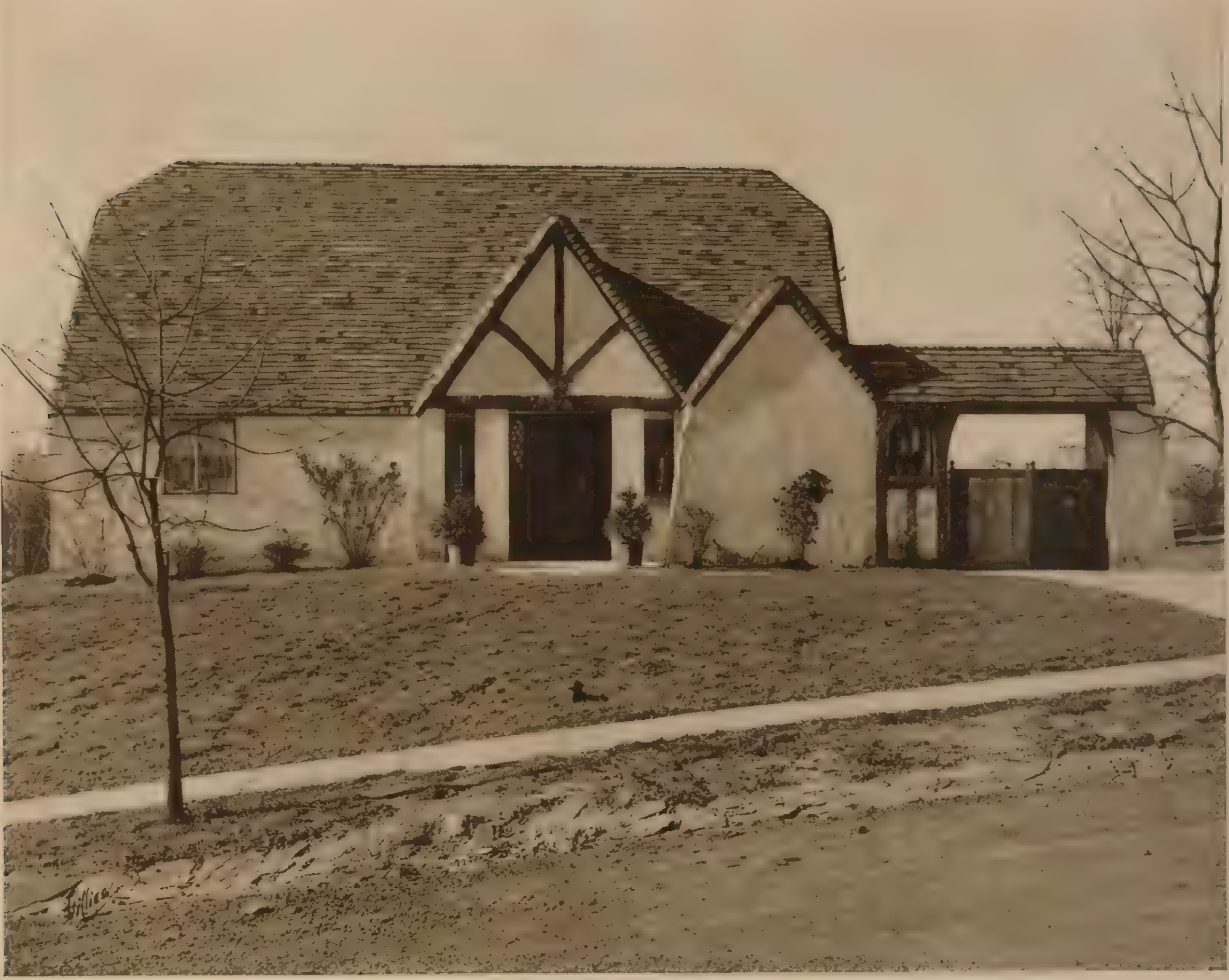


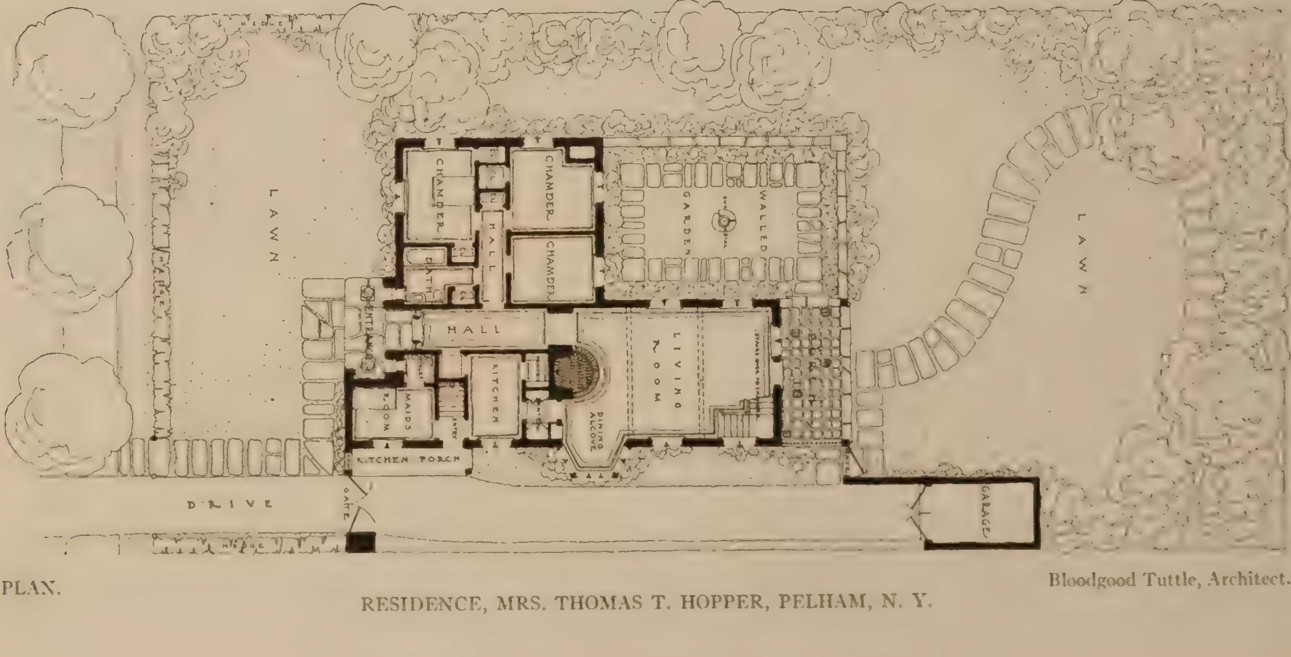
The first story in its simplicity suggests the Greek and Egyptian temples, while the treatment of the doors and windows is Romanesque in form, and the intricacy and beauty of the ornamentation suggests the Gothic and the Arabic.

The second story, in its windowed elegance, is Renaissance in line but purely Gothic in the interlaced arches of its openings.

The third story is Renaissance in feeling, restful and quiet. Above it rises the dome which suggests the Byzantine, while above the closed top is a unique feature—the beams of the dome arising like hands clasped in prayer, so as to give the feeling of ascension and aspiration heretofore found only in Gothic towers.

An intricate system of ornamentation covers the columns, surrounds the windows and doors, and comprises the dome itself, and in this one deciphers symbols of all the religions of the world.

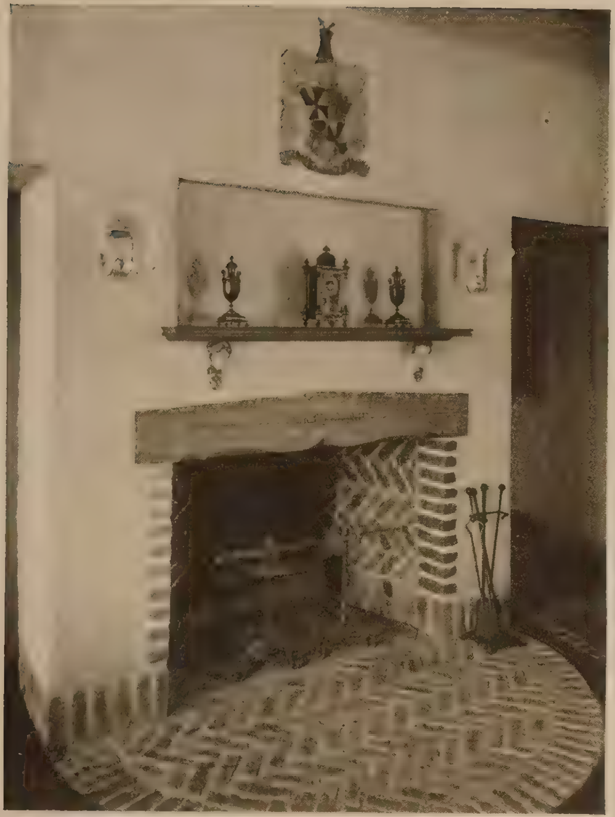




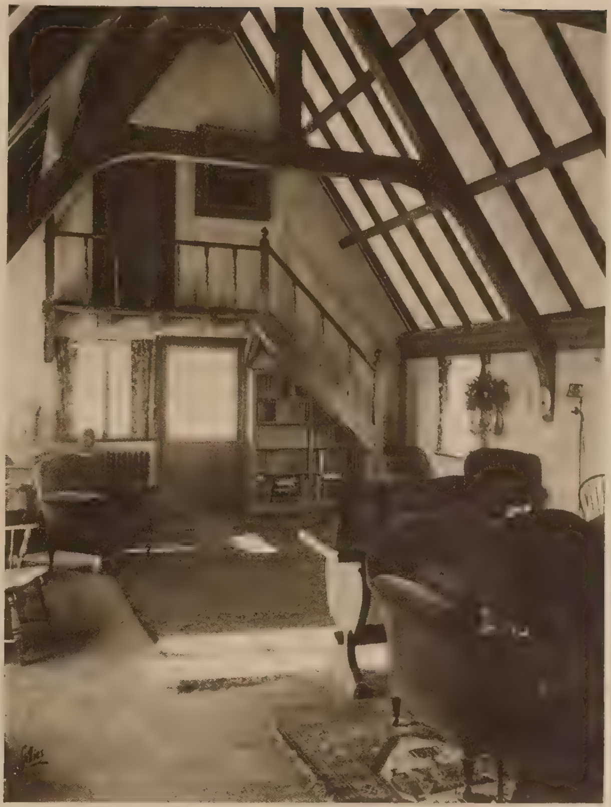
PLAN.

Bloodgood Tuttle, Architect.

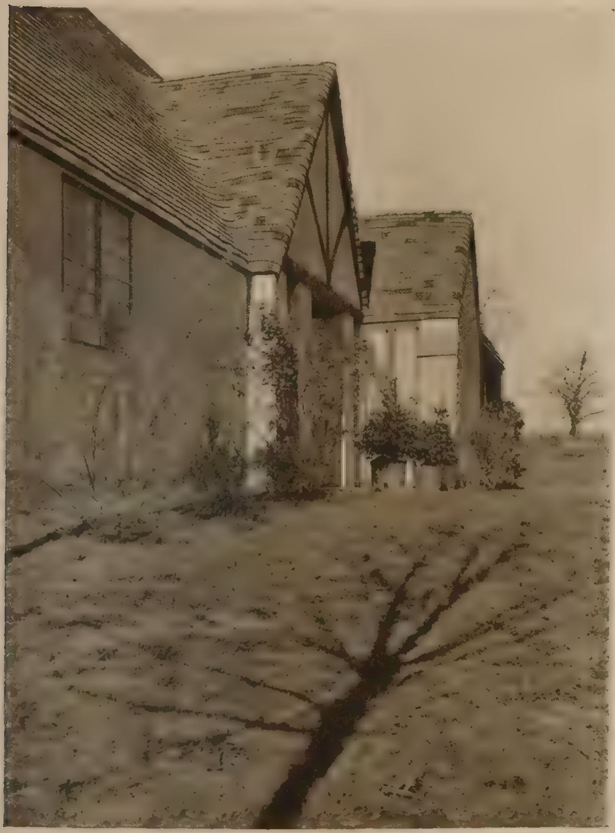
RESIDENCE, MRS. THOMAS T. HOPPER, PELHAM, N. Y.



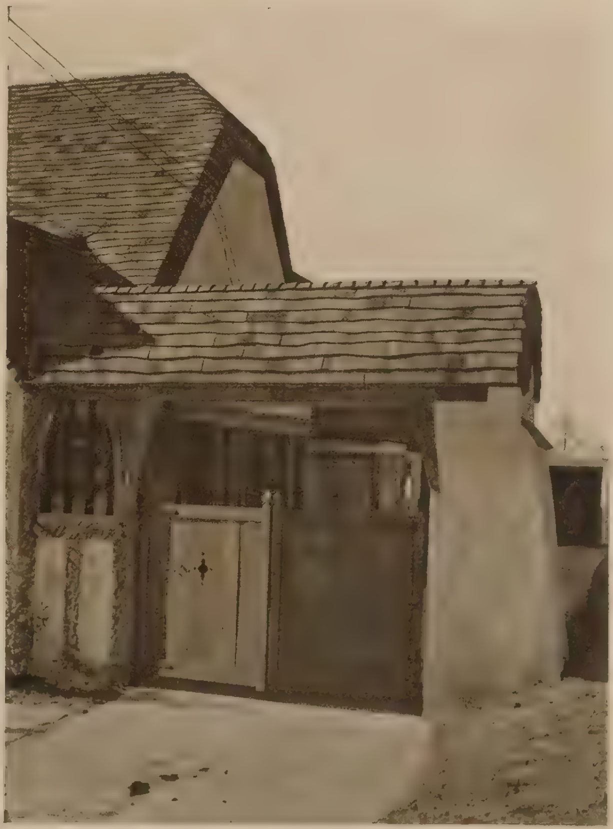
LIVING-ROOM MANTEL.



LIVING-ROOM.



DETAIL.



ENTRANCE-GATE. Bloodgood Tuttle, Architect

RESIDENCE, MRS. THOMAS T. HOPPER, PELHAM, N. Y.

An Architect's Office

By Alfred C. Bossom

WE have heard of the architect who runs a business. Also, of the æsthetic member of the profession who insists on making everything subservient to his point of view. Also, of the man whose great leaning is toward practicability at the expense of beauty, but to-day we are confronted with the necessity of combining all three of these points of view.

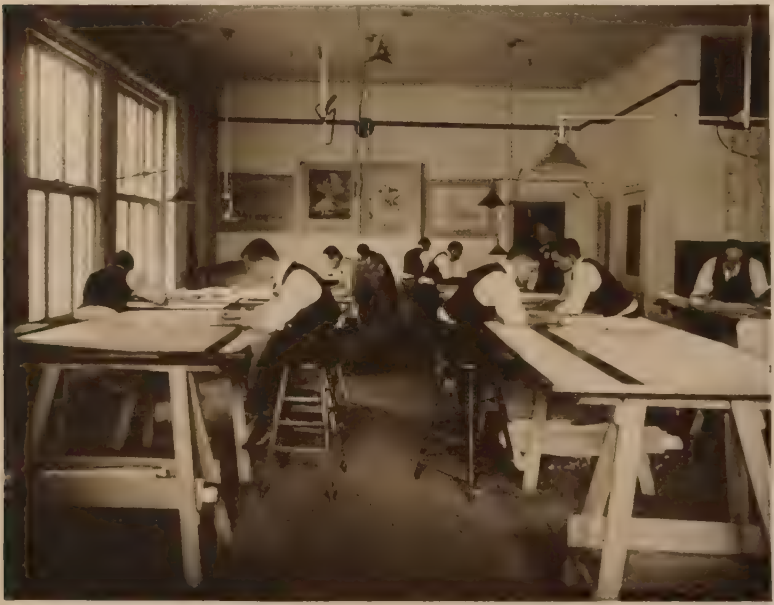
For five years general building has been at a very low ebb, and the need for more structures has been slowly increasing, so much so that now we are confronted with the task of erecting many buildings very quickly, and in doing this it is the duty to carry high the standard of American architecture.

So frequently in the past offices were laid out to express only the personal tendencies of the architect without sufficient regard to being able to absolutely fulfil the client's needs, which in the end are the controlling factors for which the office exists. When the opportunity occurred in this case an endeavor was made to meet this condition, and to so co-ordinate the functions of the office that it would run as smoothly as business would through a well-organized bank.

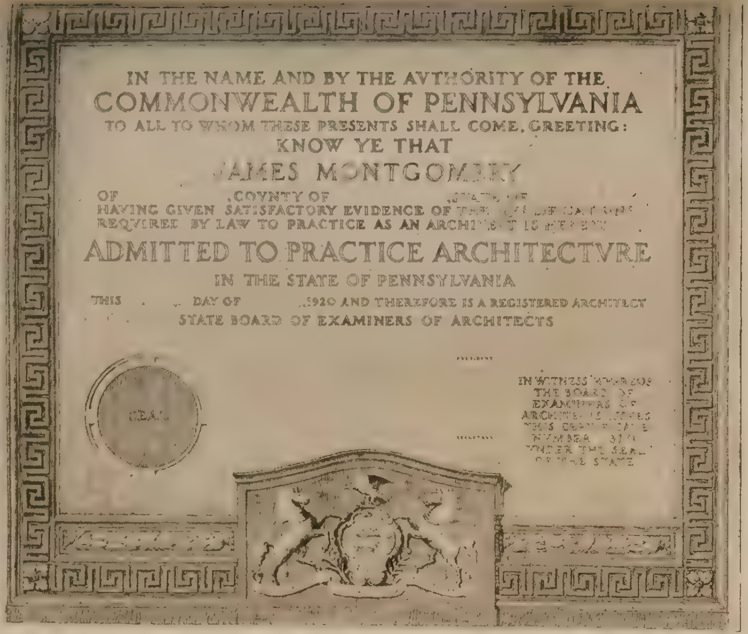
Having the opportunity of light on all four sides, and with the utilities located in the centre, it was possible to so arrange the different sections that the work travels easily, from its inception from the client to its construction by the contractor, without obstacles.

Having an open loft, there were no hindrances to carrying out a preconceived plan. At the same time making the path of the work easy, a great effort was made to build up attractive surroundings for the workers in the office and to make them as harmonious and agreeable as possible.

In carrying out this work in leased quarters, the expense naturally formed a very important consideration, and various expedients were adopted to do the work as quickly and as inexpensively as practical. For instance, throughout the entire suite of offices there is not a single foot of plaster other than that upon the exterior walls of the loft. Cardboard upon stud partitions, very heavily stippled, has been used to form the walls, with chair-rails, etc., so that this should not be damaged. The original cement floor has been tinted in various places to give the effect desired, and where the rooms are to be used for constant service either linoleum or cork has been fixed upon the same. Where a more finished treatment was needed for the walls they were boarded, and to this either marble was fixed, or canvas applied, upon which a stencil treatment was adopted. Everything has been fixed throughout with screws, so that should it be desirable to move later, all can be taken away without undue difficulty or expense, and practically without defacing the structure of the building at all.



Drafting-room.



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THIS DAY OF ,1920 AND THEREFORE IS A REGISTERED ARCHITECT
STATE BOARD OF EXAMINERS OF ARCHITECTS

PRESIDENT

SEAL

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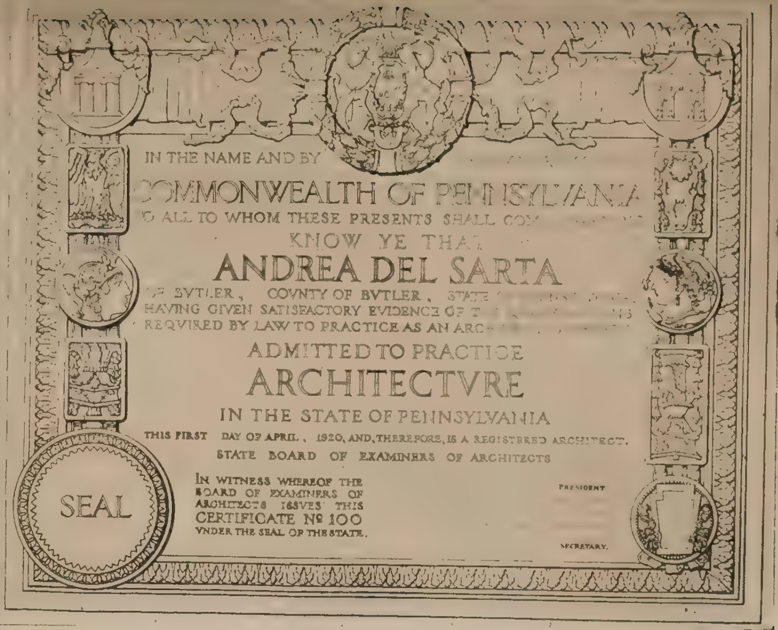
OF THE STATE

SECRETARY

NO. 8. FIRST PRIZE, FRANK L. BODINE, ST. DAVIDS, PA.



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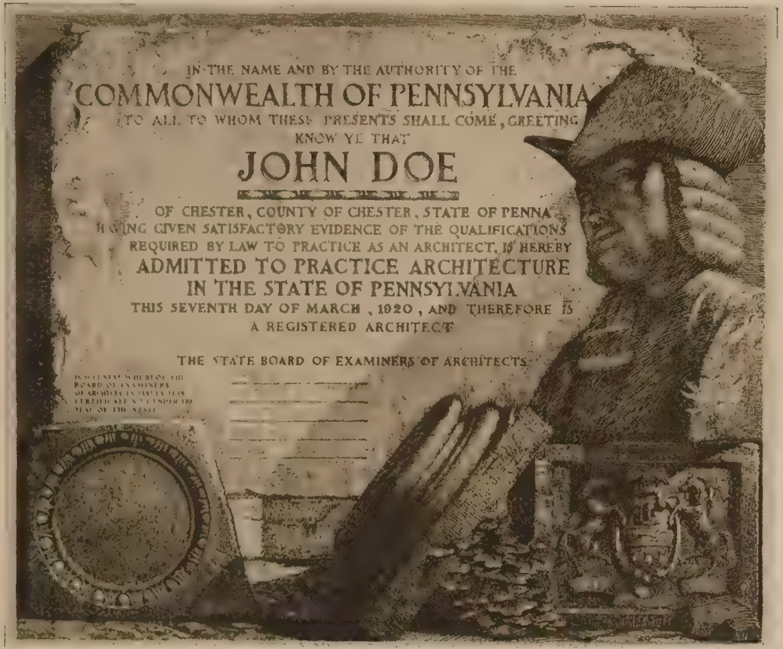
PRESIDENT

SECRETARY.

SEAL

NO. 5. SECOND PRIZE, ROBERT W. HUBEL, DETROIT, MICH.



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OF CHESTER, COUNTY OF CHESTER, STATE OF PENNA.
HAVING GIVEN SATISFACTORY EVIDENCE OF THE QUALIFICATIONS
REQUIRED BY LAW TO PRACTICE AS AN ARCHITECT, IS HEREBY
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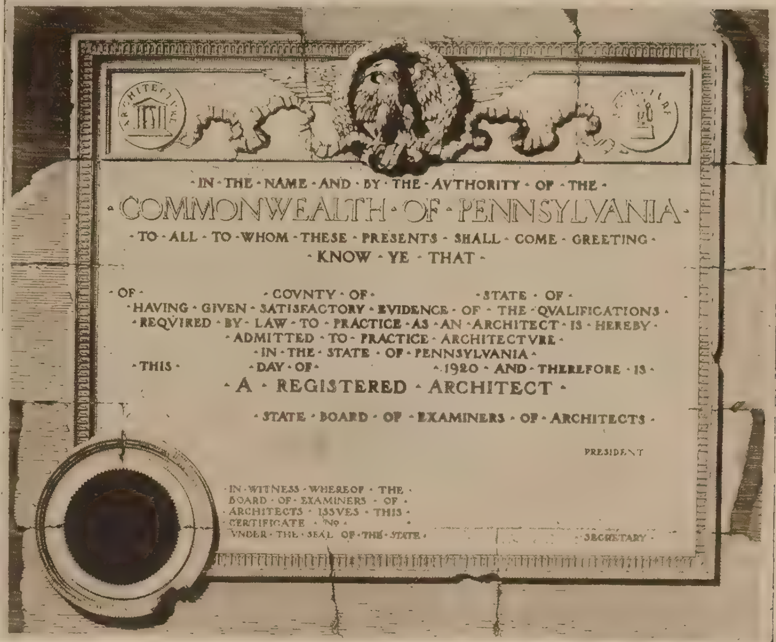
IN THE STATE OF PENNSYLVANIA
THIS SEVENTH DAY OF MARCH, 1920, AND THEREFORE IS
A REGISTERED ARCHITECT

THE STATE BOARD OF EXAMINERS OF ARCHITECTS

NO. 12. FIRST HONORABLE MENTION, GEORGE HOWE, PHILADELPHIA, PA.



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NO. 3. SECOND HONORABLE MENTION, ELLIOTT L. CHISLING, NEW YORK.

COMPETITION FOR A DESIGN FOR ARCHITECT'S CERTIFICATE, COMMONWEALTH OF PENNSYLVANIA.

Modern Building Superintendence

By David B. Emerson

CHAPTER X

HEATING AND VACUUM CLEANERS

ALTHOUGH no mention has been made so far of the heating apparatus, it has not been forgotten or neglected. As the construction work progressed the steam mains, risers, and returns were installed. The boilers were set early in the progress of the work, being delivered at the building before the steel frame was erected, and were placed in the sub-basement before the floor beams were set. The heating of the offices, corridors, etc., was done by a vacuum system of heating, using low-pressure steam.

On account of the large amount of radiation required, steel boilers were used. The boilers, three in number, were of the horizontal return tubular type, two being used for heating the building, and the third being held in reserve. A small auxiliary high-pressure boiler for heating water and for supplying heat for the Turkish bath was also installed. The boilers were 16 feet long and 72 inches in diameter, which gave a length of a little over 2½ diameters, which is the ratio generally recommended in good boiler-making practice. The tubes were of standard thickness, 4 inches in diameter, which gave them a length of 48 diameters, which is the maximum length which should be used. The boilers were made up of special high-grade steel, tested to sustain a tensile stress of 60,000 pounds per square inch, and each plate was so stamped. The boilers were riveted in the best manner, all longitudinal seams being butted, double-strapped, and triple-riveted, the vertical seams and the flanges of the dome were double riveted. The edges of all sheets were planed and bevelled before the sheets were put together, and all of the seams were caulked with round-nosed tools.

The shells of the boilers under the domes were not cut away, but were perforated to afford the free passage of steam and drainage. The boilers were thoroughly braced with crowfoot braces, made of refined steel. A manhole 11 inches by 15 inches was placed in the top of each boiler, and handholes were provided in the heads of the boilers. Each boiler had three heavy cast-iron lugs on each side, which set upon 12″ x 12″ x 1¼″ cast-iron plates, set in the brick setting. The two rear bearings were roller bearings, to allow for expansion. The boilers had full sectional cast-iron fronts, with double doors opposite the tubes, and feed and ash-pit doors. All of the iron-work was extra heavy and well bolted and screwed together, and finished with pilasters and cornices.

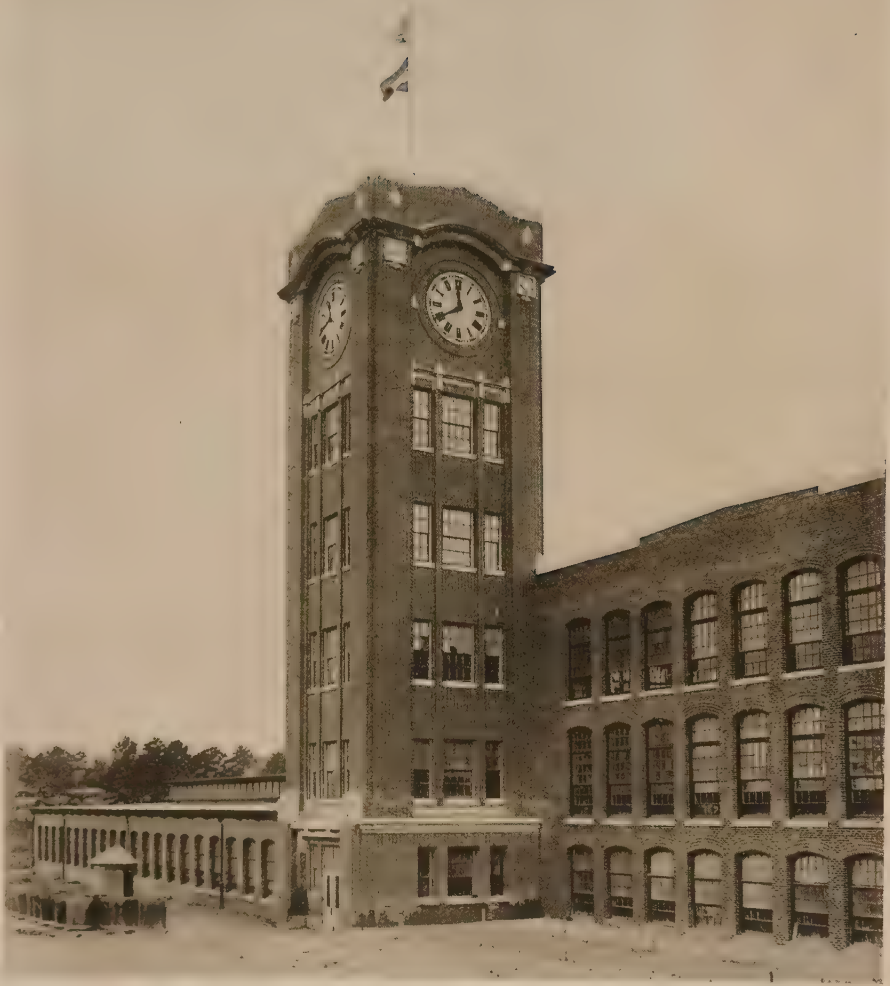
As the boiler room was below the bed of the old stream which was on the site, and there was considerable liability of the boiler pit being flooded, the boilers were placed in a water-tight steel pan. This pan was three feet deep, and wide enough to accommodate all of the boilers, and of sufficient length to allow room for firing; it was made up of ¼-inch plate, reinforced with steel angles and tees, but so constructed as to present an unbroken floor surface. Three-inch pipes, which were as long as the pan was deep, placed so as to come between the boilers, were flanged to the bottom of the pan, to give an air relief, so that the water pressure would not lift nor buckle the pan.

The boilers were set with walls of hard-burned brick, laid up in cement mortar. The side and rear walls were 18 inches thick, which included a 2-inch air space, the centre walls were 24 inches thick, and the bridge walls were 24 inches thick at the top. The walls were provided with 6-inch steel I-beam buckstays, with tie bolts and anchor rods. The tops of the boilers were levelled off with porous terra cotta blocks, 4 inches thick, supported on steel tees set 13 inches on centres. The walls of furnace, bridge walls, and the back connections were all lined with fire brick laid in fire clay. The fire brick were laid up dry, and the fire clay was mixed to the consistency of thick soup, and the brick were dipped in the clay and then laid in place, and well hammered down, so as to get the thinnest possible joints. The ash pits under the boilers were paved with hard paving brick, laid on edge and thoroughly grouted with cement mortar.

Each boiler had a separate smoke flue, so placed that the fire gases passed under the boiler shells, then forward through the tubes, and then across the front through the vertical flues, which connected with the main flue, which was increased in size for each boiler flue connection. The smoke flues and connections were made up of No. 10 gauge wrought iron, riveted with ⅜″ rivets, with 3″ pitch, all of the connections being made perfectly tight. The flues were supported by means of wrought-iron hangers, fastened to the steel floor beams above the boiler room. Each flue was provided with cleaning doors, and had a pivoted hand damper, and the main flue had a damper regulated with an automatic damper regulator. The flues from the boilers and the main flue were covered with No. 26 gauge, galvanized metal lath, securely fastened to steel angle framework, which was built around the flue, and then plastered with 2 inches of magnesia covering. The boiler flue connected with the chimney stack, which was made up of ⅜″ steel plate, riveted with ⅝″ rivets, with a 4″ pitch, all joints being caulked and made gas tight. The flue was built up in 20-foot sections, and it was erected in conjunction with the steel framing. Each section of the flue was supported by means of two 6″ I-beams, bolted to the floor beams. A horizontal section with an outlet flanged with 3″ x 3″ angles extended into the boiler room and was connected to the boiler flue. The stack had a cleanout, with a hinged door at the bottom.

The boilers had 3″ blow-off cocks and valves, and blow-off pipes to the blow-off tank. The blow-off pipes were extra heavy pipe, to resist any sudden stress which might be liable to occur in them. The blow-off tank was 3 feet in diameter by 6 feet long, with a manhole at one end. The shell was constructed of best open-hearth iron, 5/16″ thick, and the heads were of flange iron, ⅜″ thick. The tank was riveted, caulked, and braced, and had a drain-pipe connected to the house drain outside of the vault wall, and it was also provided with a vapor pipe which was carried up 10 feet above the main roof, and capped with a galvanized iron exhaust head. A cooling coil was installed in the tank, connected with the water supply and with the discharge pipe.

(*Continued on page* 190.)



WINNSBORO MILLS, WINNSBORO, S. C.

This plant was purchased by the present owners in 1916, and consisted of a three-story main mill, two-story weave building, boiler-engine house, etc., together with a village of low-grade houses, located close to the mill and on low ground.

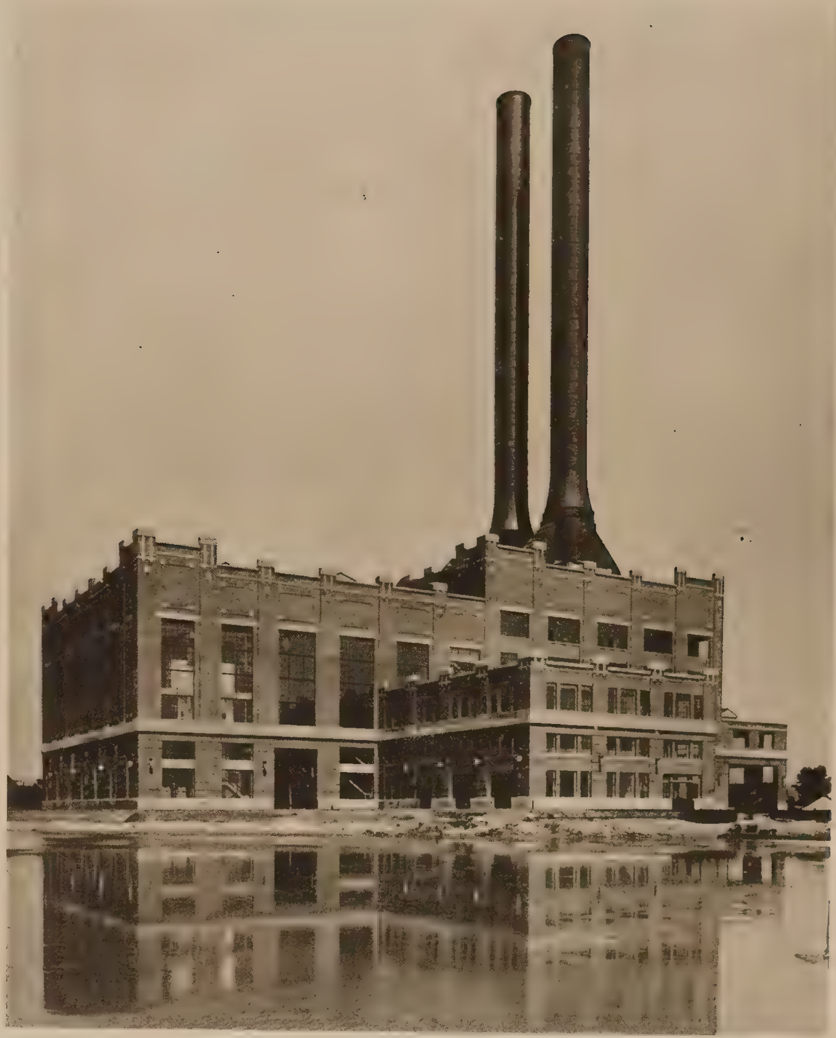
In order to increase the capacity of the plant to 3,000,000 lbs. of tire fabric per year, it was found necessary to make a complete reorganization of the old mill and its machinery, so that the plant to-day, as designed by Lockwood, Greene & Co., Engineers, is practically a new productive unit.

A new village was laid out on high land some distance from the mill with streets, sidewalks, etc. Such of the old houses as could be were moved to new positions, and new houses, together with community buildings, were erected.

The original mill building was 75 ft. by 355 ft., with three stories for half the length and two stories for the remainder. The new extension is 103 ft. wide and 366 ft. long, three stories high.

Everything that could be done to make this a perfect plant, within reasonable expense, was done. Lockers are provided for the employees, the toilet facilities are of the best, drinking-water distributed throughout the plant is pure and cold. Space has been provided for rest rooms, etc.

A clock, with four illuminated faces, in the tower acts as a master clock for an entire system of secondary clocks through the plant and also serves the entire village by day and night.



The power-plant of the Detroit Edison Company embodies the most advanced principles of power-house construction. The plant was designed by the company's own engineers and erected by the company.

Natural ventilation is used throughout the plant, Mr. H. H. Esseltyne, chief construction engineer of the company, having made a special study of the question of natural ventilation and its solution as worked out by prominent engineers of the United States and Europe.

His conclusions are as follows:

(1) Use large areas of window-walls, adequately and scientifically equipped with ventilators.

(2) Over turbines and boiler-room install monitors to take off heated air.

(3) In monitors use continuous sash to give wide exit and maximum ventilation.

(*Continued from page* 188)

Each boiler was equipped with a 2″ feed valve, with stop and check valves, and had a combination water and steam gauge with try cocks, and brass safety valve, with lock-up attachment.

The steam distribution was accomplished by means of a down-feed system of piping. The main supply was taken from the steam header over the boilers, and was connected with the rising main, which ran up to the ceiling space over the twentieth story. The riser had an expansion loop located at the tenth-story ceiling. The loop was so constructed that all of the movement caused by the expansion of the pipe was taken up by the turning of the pipes in the fittings, and no strain was placed on any part of the piping. The expansion loop was hung at the far end in an adjustable wrought-iron hanger secured to the steel floor beams. The riser was anchored to steel framing at the fifth and fifteenth floor levels, by means of adjustable pipe anchors. From this main riser a series of distributing mains hung from the roof beams by means of adjustable expansion hangers, were run above the ceiling, to feed the down-feed risers.

All of the pipe used in the heating system was standard lap welded, puddled wrought-iron pipe, and all fittings were standard cast-iron fittings. The fittings on the boiler header, the main feed line, and the main riser were standard cast-iron flanged fittings, with companion flanges on the pipe, and they were put together with copper gaskets. The ends of all pipe were reamed out to remove all burr caused by cutting. Before installing the pipe each length was stood on end and pounded, to remove all loose scale, dirt, rust, etc. The use of red lead, or pipe cement, in the joining of pipe and fittings was not allowed, joints having to be screwed up and made tight, without the use of these materials.

The connection from each boiler, of steam header, the main supply, the main riser, the distributing mains, and each down-feed riser were valved. The valves in all of the horizontal lines were gate valves. All valves over 2 inches in diameter had iron bodies, with steam metal mountings, and all valves of 2 inches diameter or under were of steam metal. The down-feed risers were run from the distributing mains down to the second floor, decreasing in size as they descended. The return lines started at the twentieth floor and ran to the sub-basement, increasing as they descended. Wherever the pipes ran through the floor, they were fitted with nickel-plated, hinged, floor and ceiling plates.

The radiator runouts were taken off the risers above the floor, and care was taken to see that they were pitched toward the riser in all cases, and that there were no sags nor pockets to cause trapping. The radiation in the corridors, brokers' offices, and minor rooms on the first floor and basement was supplied by an up-feed system, taken off the main steam supply, the returns being taken into the main return line. All of the radiators throughout the building were plain cast-iron hot-water pattern radiators, the difference between steam and hot-water radiators being that steam radiators have both the supply and return tappings at the bottom, whereas hot-water radiators have the supply tapping at the top, and the return tapping at the bottom. This type of radiator is preferred for vacuum systems of heating. All of the radiators were thoroughly washed out at the foundry to remove all core sand and other foreign matter. The air-vent tappings were plugged with permanent iron plugs, and the supply and return tappings were plugged with wooden plugs, which were not allowed to be removed until the radiators were ready for connecting up. The radiators had modulating valves on the supply end, which allowed a regulation of temperature by the controlling of the circulation of steam, by throttling the inlet on each radiator.

The vacuum traps on the return ends of the radiators were of the sylphon type, operating on the thermostatic principle, using a sylphon bellows made up of a multiple construction of seamless brass folds. These traps allowed the free passage of air and water, but were closed by the action of heat and prevented the leakage of steam. The return lines were connected to the return main in the sub-basement. This line was graded in the direction of the flow of the condensation, and ran to the vacuum pump. A suction strainer was provided between the suction end of the pump and the end of the line, to prevent dirt and scale entering the cylinder of the pump. The supply line and the main riser were dripped into the vacuum return line, and they were provided with gate valves, dirt strainers, and sylphon traps. The vacuum pumps were electrically driven, direct-connected, rotary pumps, with automatic float control switches. An air-separating tank for eliminating the air from the condensation was placed between the vacuum pumps and the boilers.

The heating of the banking-rooms and the safe-deposit department in the basement was accomplished by means of an indirect system of heating, with a fan and air washer, and fitted with a temperature-regulating system. The apparatus was located in the sub-basement. The fresh air was taken through the intake into the fresh-air chamber, which was made as nearly air-tight as was possible, to prevent taking air from the interior of the building. The fresh-air chamber was connected with the tempering coils, which were made up of 1″ wrought-iron pipes, in four-row sections, set into a cast-iron base, which was connected with the steam header. These coils were encased in galvanized sheet casings, firmly braced with steel angles. The air washer adjoined the tempering coils. This sat on a tank made up of No. 14 gauge sheet iron, braced and riveted to a galvanized steel angle frame, with all seams and rivet heads soldered over to make them water-tight. The upper casing was of galvanized sheet iron, braced with galvanized steel angles, and all seams and rivet heads soldered over as in the tank. The principal features of the air washer were the diffuser plates on the intake side, which were of heavy gauge galvanized iron plates; these served the double purpose of evenly distributing the incoming air and maintaining an even velocity through the spray chamber, and preventing any back splash of atomized water from the spray chamber. The bottom header risers and spray nozzles were placed in front of the diffuser plates, which gave a body of atomized water, through which the tempered air passed, was humidified, and all dust, soot, etc., removed. At the discharge end of the washer were the eliminator plates, which removed the entrained water from the air. These were placed in tiers and a spray pipe was arranged to flood them and keep them washed and cleaned.

The air washer had a direct-connected, motor-driven, centrifugal recirculating pump, and the tank was provided with strainers of fine copper mesh to prevent the dirt which was washed from the air from reaching the pump and the spray nozzles. The tank had an overflow trap and drain to the sewer, and a valved waste was located in the bottom of the tank for emptying purposes. The fan was of the multivane, direct-connected, motor-driven type, with a speed of 425 revolutions per minute. It was set in a sheet steel housing. The discharge of the fan connected with the heating coils, which were of the same construction as the tempering coils, and set in a galvanized sheet steel casing, which was connected with the ducts. The returns from the tempering coils and the heating coils were fitted with vacuum traps with thermostatic disks, and were connected to a special return main connected with the vacuum pumps. Individual ducts ran from the heating chamber to the various outlets in the basement and the first floor. Where the horizontal branches in the sub-basement connected to the riser ducts and flues, especial care was taken that there should be no abrupt turns, all of the curves having a long inside radius.

All ducts and flues were built of galvanized sheet steel. Where one dimension was 48 inches or over, No. 20 gauge metal was used, and they were braced with steel angles. Where one dimension was 30 inches or over, No. 20 gauge metal was used, and where they were 12 inches or over, No. 22 gauge metal was used. The ducts were made with slip joints, presenting a smooth surface in the direction of the flow of the air. Each duct was fitted with a mixing damper, controlled by a pneumatic thermostat located in the room to which the ducts lead. These thermostats were supplied with compressed air from a small hydraulic air compressor located in the sub-basement. The compressed air was carried to each thermostat by means of a small pipe concealed in the wall, and a branch pipe connected the thermostat with the damper. The registers were placed in the walls, and in the front of the marble bank screens, boxes being provided at the ends of the duct for attaching the registers, which were of cast bronze, finished to match the bank fixtures. All register boxes were closed up with boards until the completion of the building, to keep out dirt and rubbish.

When the system was completely installed, all of the exposed piping in the basement, the main riser, and the distributing mains were covered with sectional magnesia covering, all fittings and flanges being covered with magnesia blocks and magnesia plastic, smoothly trowelled. The coverings were finished with an 8-ounce canvas jacket, put on over heavy sheathing paper, and well sewed with approximately three stitches to the inch, and held by means of japanned bands, and then given two good coats of lead and oil paint. All pipes and fittings which were not covered, and all hangers and other ironwork, including the boiler fronts, were painted two coats of best black Japan varnish. All radiators and all of the exposed piping was given a coat of yellow ochre, and a coat of special primer, and bronzed with liquid bronze, except in the toilet-rooms, where they were enamelled with white radiator enamel.

Before turning the system over to the owners, the contractor tested it out thoroughly in our presence. The boilers were tested by the makers before delivery to a hydrostatic pressure of 100 pounds to the square inch. The boilers were filled with water, and the entire system was started under pressure, to clean it out. The condensation was allowed to waste into the sewer, instead of returning to the boilers, a globe valve being provided under the strainer for that purpose. This was continued for several days, until the system was cleaned of grease and dirt. Then the safety valves were temporarily reset, and the pressure was run up to 15 pounds, and kept there until all piping, joints, valves, and connections could be examined, and those few which we found defective were made tight; one or two radiator sections were found to be cracked and were replaced by perfect ones. The boilers were blown off and the interiors of the sylphon traps were removed and the traps were thoroughly cleaned. The vacuum pumps were then started, and the vacuum control was regulated to start the pump at from two to three inches of vacuum, and to stop the pump at from five to six inches of vacuum.

A vacuum-cleaning plant was installed. Two four-sweeper cleaners with two risers each were installed. By four-sweeper cleaners it is meant that four sweepers can be used at the same time. The piping for the vacuum-cleaners was installed at the same time that the steam piping was installed. All of the pipe was standard-weight, black wrought-iron, screw-jointed pipe, smooth on the inside, and free from dents, kinks, fins, or burrs, and all fittings were cast-iron recessed drainage fittings. The ends of all pipe were squared and reamed smooth, and the threads were cut so that the pipe would screw into the fittings in such a manner as to leave a practically smooth passage through the pipe and fittings. Brass cleanout plugs were installed at the base of all risers, and they were set so that they pointed in the direction of the flow of air. All horizontal pipe was supported by means of adjustable pipe hangers, spaced not less than 10 feet apart, and all risers were secured to the steel floor beams. The inlets were of nickel-plated brass, with self-closing covers, and they were placed in the baseboard in all cases, and were so located that a 50-foot length of hose would reach to all points, and each cleaning radius overlapped the adjoining radius.

The cleaners were located in the sub-basement. The exhausters were of the centrifugal fan type, with 10 horse-power motors direct-connected to the shaft of the fan. A 5-inch exhaust pipe was run from each cleaner, and was carried overhead on the sub-basement ceiling into the pipe shaft, up to and through the roof, and fitted with a galvanized-iron exhaust muffler. The motors were provided with 75-ampere double pole, single brake, knife switches, one double-pole circuit breaker, and starting rheostats of proper capacity to control the motors. The cleaners had dust separators to prevent dirt and dust from passing through the vacuum producers.

After the cleaners were installed they were tested out as follows: All of the piping was subjected to 7½ pounds air-pressure, to determine the tightness of the system. We then had an operating test made by selecting four outlets, two on each riser, to which was attached 100 feet of hose of the size which was to be used on the system, with the ends open. The exhauster was required to maintain the specified vacuum when running at or under the specified speed, and the power consumed was not to exceed 14 kilowatts. As a test of the tightness of the whole system and the effectiveness of the vacuum control, the exhauster was run with all outlets closed and the power consumed was not allowed to exceed 50 per cent of that at the full load.

A final test was made of the separators. We selected four convenient points near four outlets, two on each riser. The contractor then spread on the floor, evenly covering the surface, or four spaces 7 feet square, a mixture of 24 pounds of dry, sharp sand, that would pass through a 50-mesh sieve, 12 pounds of fine wheat flour, and 4 pounds of finely pulverized charcoal. Fifty feet of hose was then attached to each of the four outlets, and all of the surfaces were cleaned simultaneously. When all of the sand, flour, and charcoal had been taken up, the exhausters were stopped, and the dirt was removed from the separator and spread upon the floor again, and the operation was repeated until the floor had been cleaned four times. On the completion of this test the cleaners were examined, and more than the required 95 per cent of the dirt removed was found in the separators, so the system was accepted and it was turned over to the owners' employees to be operated.

Announcements

A Correction.—In the alteration of the building at 512 Fifth Avenue, shown in the May number, the store of the A. Sulka Co. should have been credited to Alfred Freeman, architect, and that of the National City Co. offices to Starrett & Van Vleck.

H. H. Whiteley, of Los Angeles, California, formerly at 429 Story Building, begs to announce the opening of new offices and studio, "La Cabana Azul," 520 South Western Avenue, for the practice of architecture, building, decorating, and furnishing. He wishes samples and catalogues.

Beverly S. King and Shiras Campbell have removed their offices from 103 Park Avenue to 36 West 40th Street, New York City.

Clifton Lee, Jr., and Merrill C. Lee desire to announce the formation of a new partnership, Lee & Lee, architects and engineers, and have opened an office at 918½ East Main Street, Richmond, Va. Manufacturers' catalogues and samples are requested.

At the annual convention of the New York Society of Architects, held at the United Engineering Society Building on May 19, James Riely Gordon was unanimously re-elected for the fifth consecutive term as president; Adam E. Fisher, of Brooklyn, first vice-president; Edward W. Loth, of Albany, second vice-president; Frederick C. Zobel, of New York, secretary; Henry Holder, of Brooklyn, treasurer, and Walter H. Volckening, of New York, financial secretary.

The seriousness of the building, housing, and labor situations was discussed at length. Many committees reported, and many others were appointed to investigate these conditions.

Warren W. Day announces that he has formed a co-partnership with Mr. Clark Wesley Bullard, architect, of Champaign, Ill. Mr. Bullard, who is a State licensed architect, is a graduate of the School of Architecture of the University of Illinois, was for several years associated with Bullard & Bullard, well-known architects of Springfield, Ill., and has, for the last four years, been with Professor James M. White, supervising architect of the University of Illinois. A general practice of architecture will be conducted under the firm name of Day & Bullard, at 527 Main St., Peoria, Ill.

Sanford O. Lacey and Gerald G. Schenck, of the firm of Lacey and Schenck, architects, announce that George Bain Cummings, formerly of New York, has been admitted to partnership. The new firm will be known as Lacey, Schenck and Cummings, and will continue the practice of architecture, with offices at 514–516 Phelps Building, Binghamton, N. Y.

Messrs. York, Regan & Burke wish to announce that they have formed a partnership, March 13, 1920, to be known by the firm name of York, Regan & Burke, located at 1323 North Clark Street, Chicago, Ill., as architects and engineers.

Charles W. Deusner and Helen Dupuy Deusner announce that they have resumed the practice of landscape architecture in Southern California, under the firm name of C. W. & H. D. Deusner, with an office at 15 North Euclid Avenue, Pasadena, California.

Roy A. Benjamin and Harry M. Prince announce the establishment of offices under the firm name of Benjamin & Prince, architects, 2003½ Main Street, Dallas, Texas.

The Indiana Limestone Quarrymen's Association, Bedford, Ind., announces the establishment of a metropolitan service bureau, under the management of George Bangs McGrath, 489 Fifth Avenue, New York City.

Benjamin Howell Lackey announces that he has opened offices at 509 Federal Street, Camden, New Jersey, for the practice of architecture.

Mr. George O. Rogers announces that on and after May 1, 1920, he will be located in Suite 608–9–10, Penn Office Building, 706–8–10 Penn Avenue, Pittsburgh, Pa.

The Stanley Works, New Britain, Conn., has purchased the manufacturing business of The Stanley Rule & Level Company. The Stanley Works will now own and operate some twelve different plants and properties, located where for years the workmen have grown up and become accustomed to the exact requirements needed in the production of the particular articles that are manufactured in these factories. In connection with these are operated open-hearth steel works, hot and cold rolling mills, foundries, timber lands and sawmills for furnishing much of the raw material used.

Book Reviews

"HOW TO USE CEMENT FOR CONCRETE CONSTRUCTION FOR TOWN AND FARM, INCLUDING FORMULAS, DRAWINGS, AND SPECIFIC INSTRUCTIONS TO ENABLE THE READER TO CONSTRUCT FARM AND TOWN EQUIPMENT." By H. Colin Campbell, C.E. Chicago: Stanton & Van Villet Co.

This is a practical book, written by an authority of wide experience in his subject. The 250 illustrations from photographs and drawings admirably supplement and make clear the various particular uses of cement dealt with in the text.

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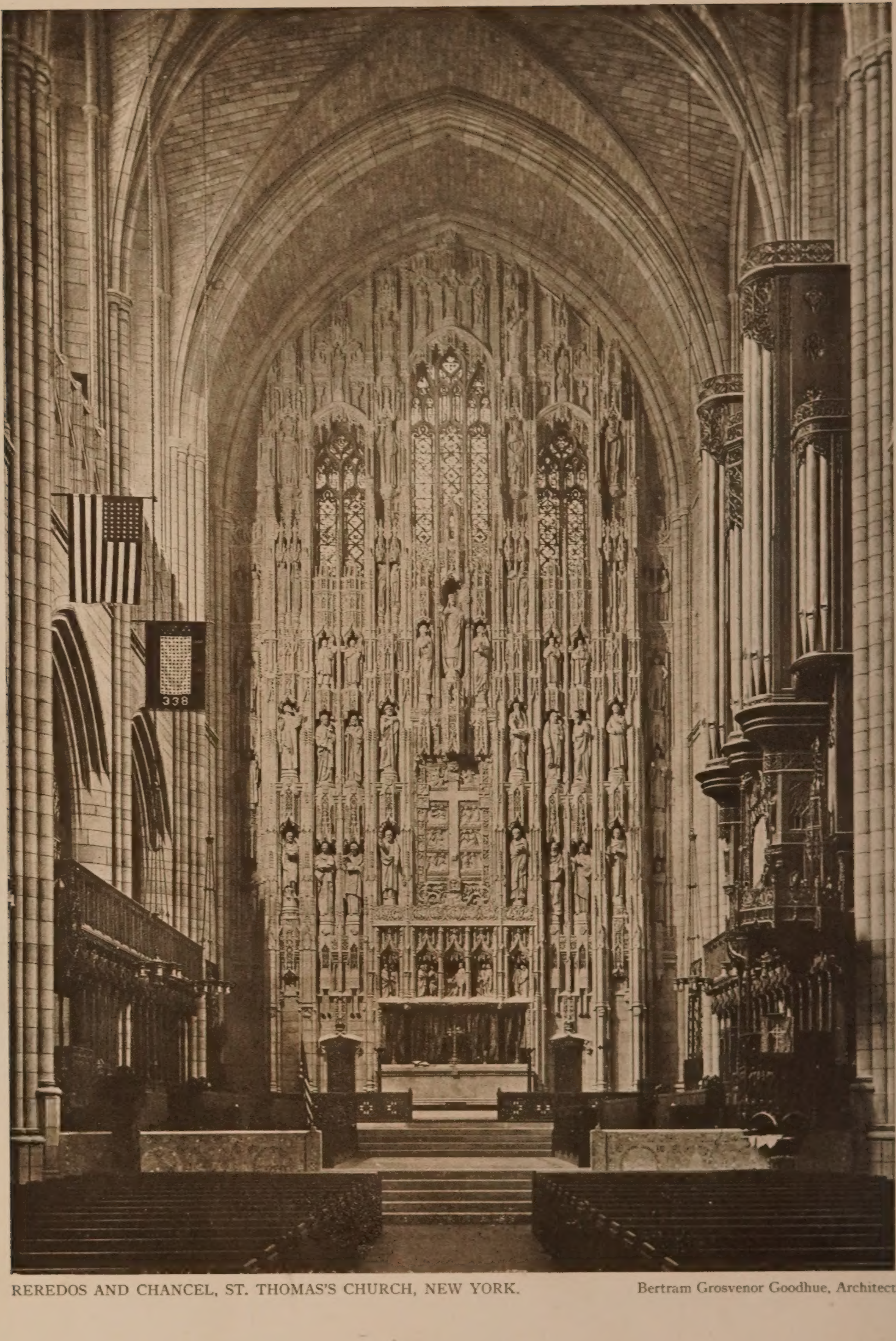

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